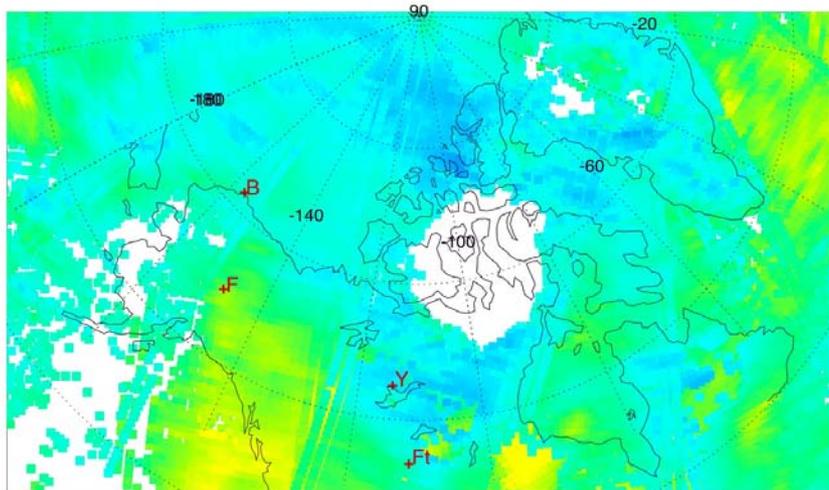


AIRS NRT ARCTAS Support: latest CO & CH₄

Juying Warner and Zigang Wei

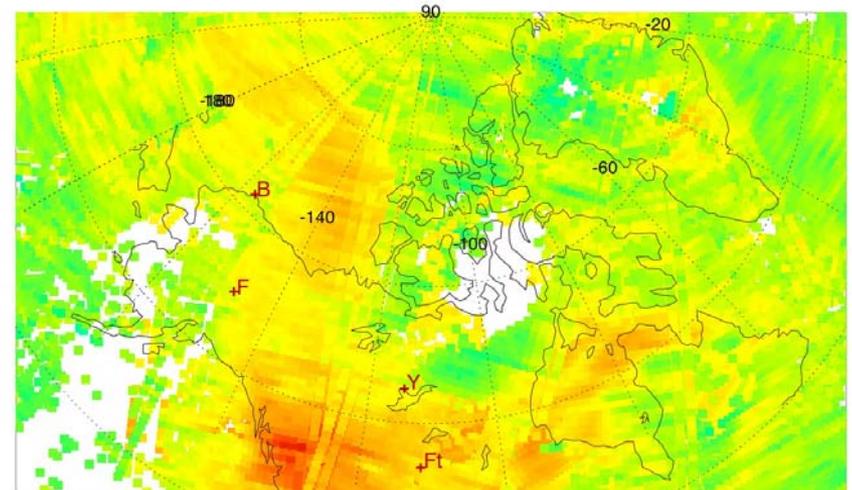
AIRS CO_VMR (ppbv) at 500mb on 20080330 for ARCTAS



0.0 27.8 55.6 83.3 111.1 138.9 166.7 194.4 222.2 251

CONTACT: Dr. Juying Warner <juying@umbc.edu>; ACKNOWLEDGEMENT: AIRS NRT products by NASA DA.

AIRS CH₄_VMR (ppbv) at 500mb on 20080330 for ARCTAS



1500.0 1555.6 1611.1 1666.7 1722.2 1777.8 1833.3 1888.9 1944.4 200

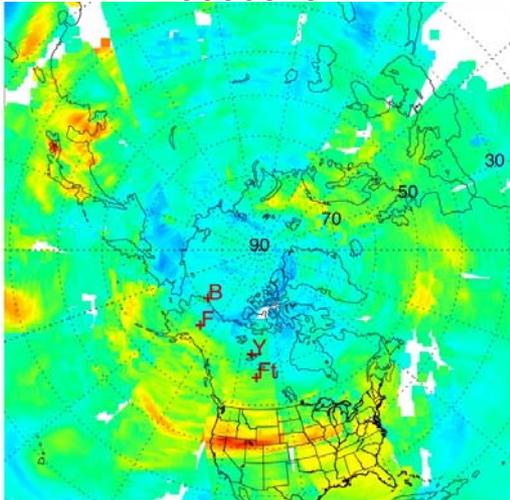
CONTACT: Dr. Juying Warner <juying@umbc.edu>; ACKNOWLEDGEMENT: AIRS NRT products by NASA DA.

- AIRS CO at 500mb (ppbv) show similar patterns over the Arctic region for the last few days
- Local CO over Barrow and some transported CO at Ft. McMurray
- Higher CH₄ concentrations over the West coast of Canada.

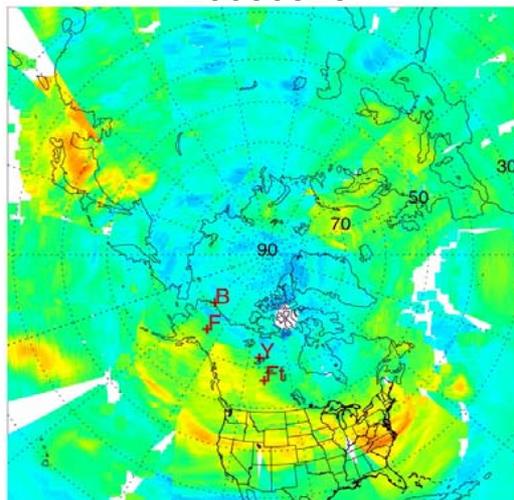
AIRS NRT ARCTAS Support: CO Transport

CO Transport affects Ft. McMurray not Barrow

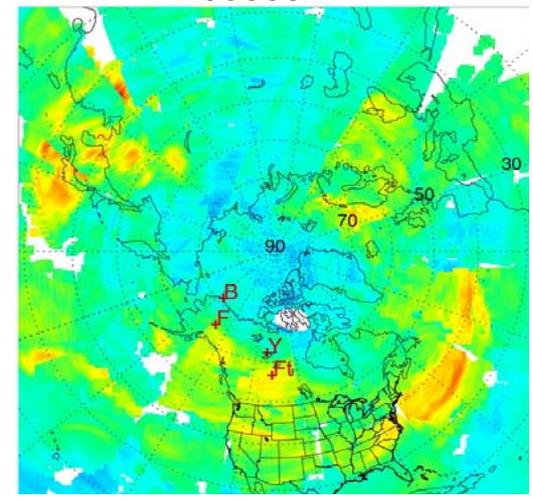
20080325



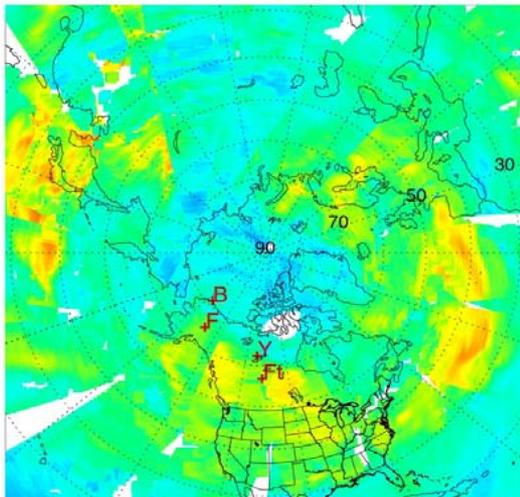
20080326



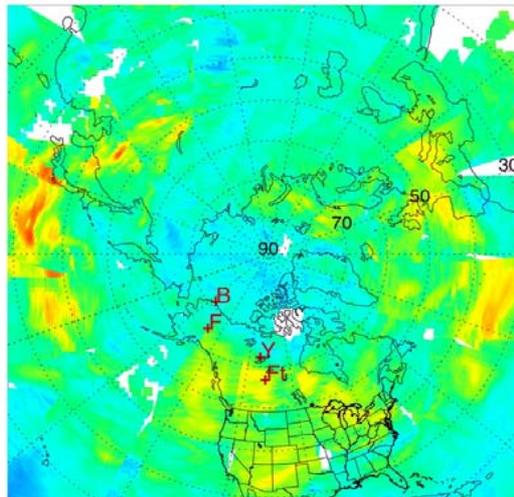
20080327



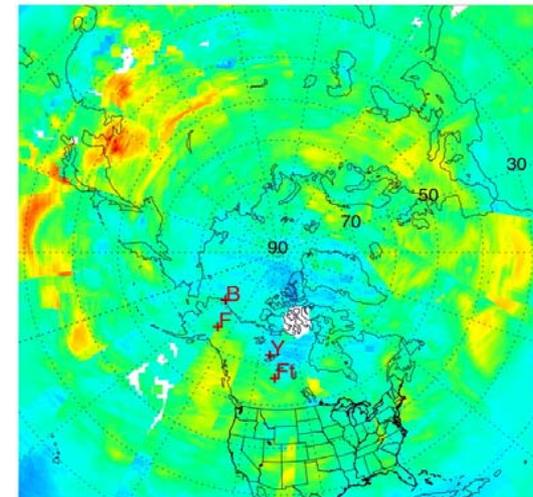
20080328



20080329



20080330

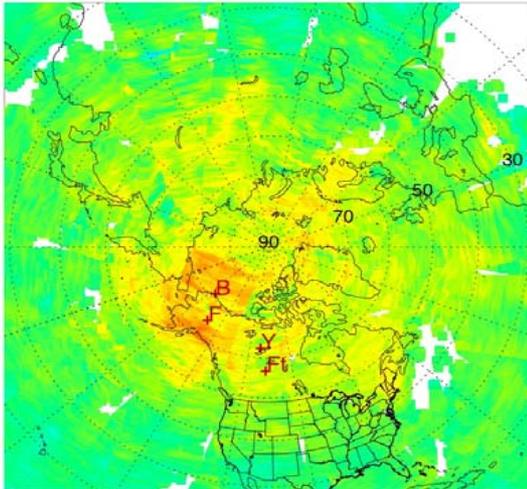


0.0 27.8 55.6 83.3 111.1 138.9 166.7 194.4 222.2 250.0

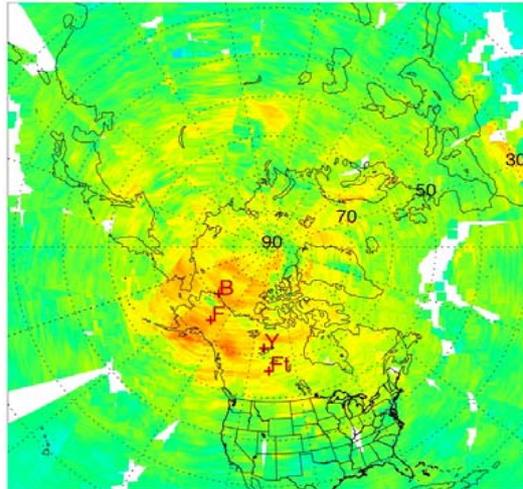
AIRS NRT ARCTAS Support: CH4 Changes

Continued high concentrations over Alaska and West Coast of Canada

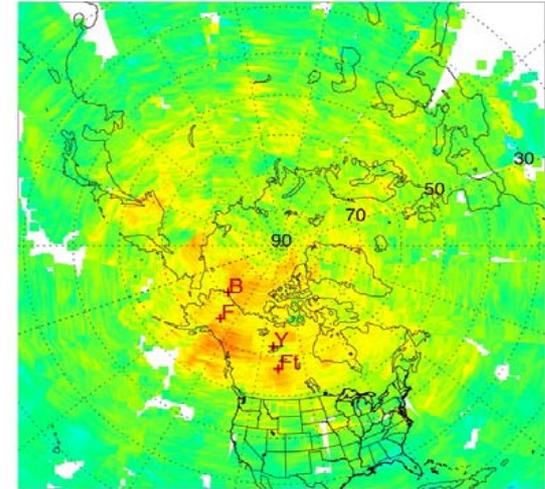
20080325



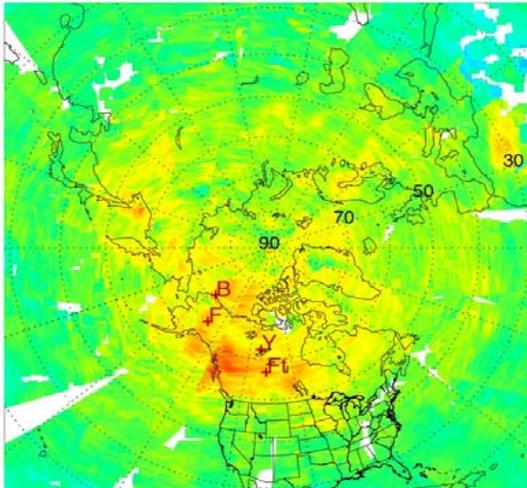
20080326



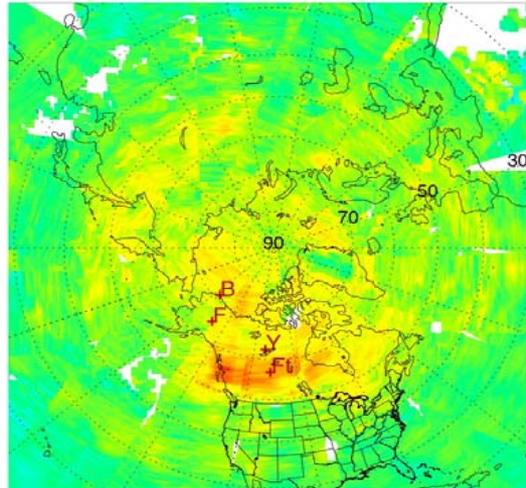
20080327



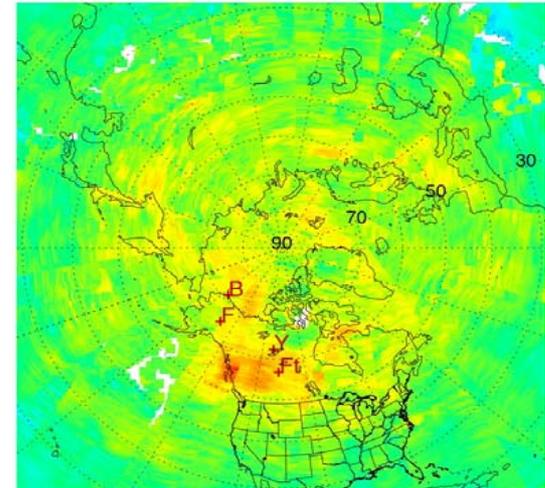
20080328



20080329



20080330

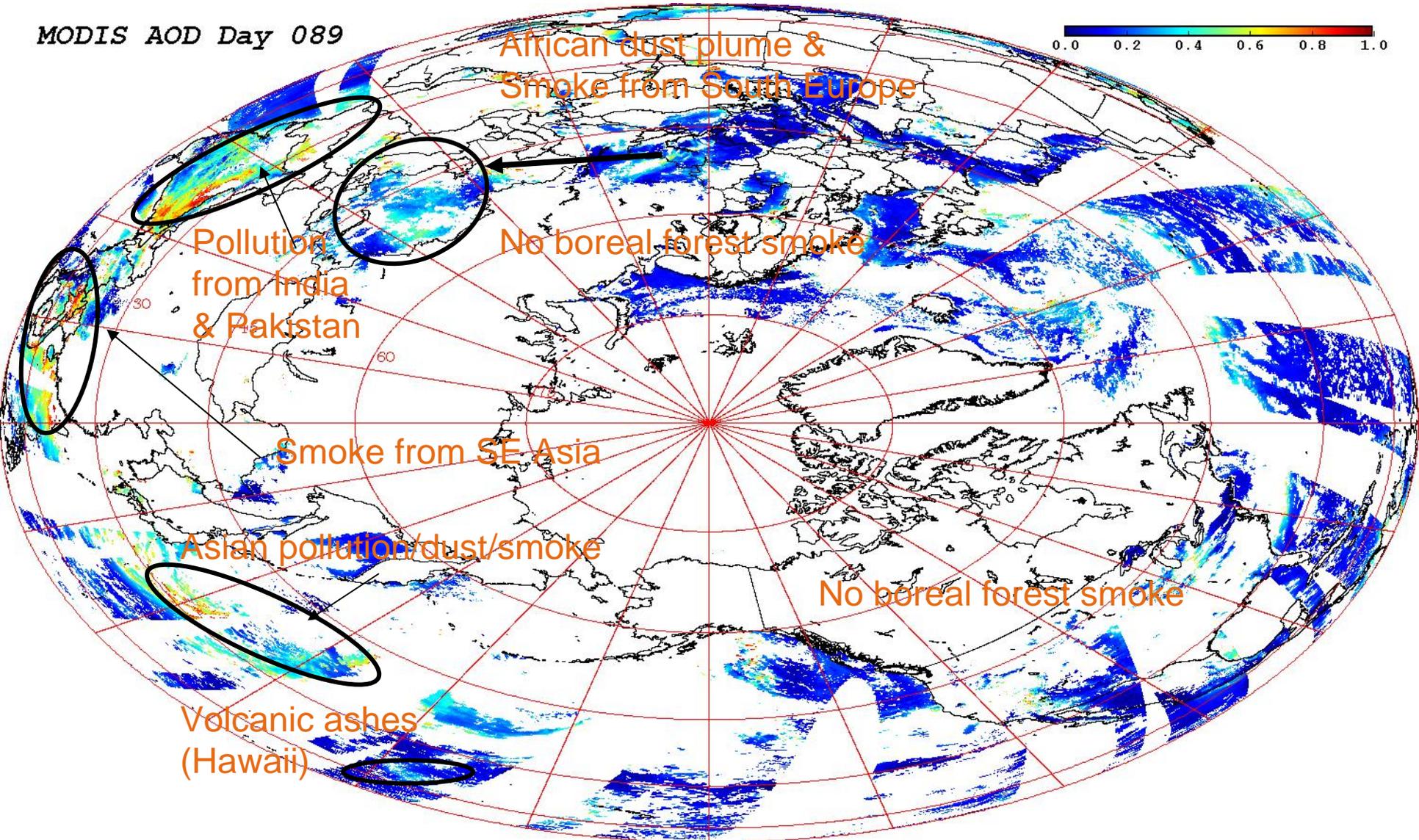


1500.0 1555.6 1611.1 1666.7 1722.2 1777.8 1833.3 1888.9 1944.4 2000.0

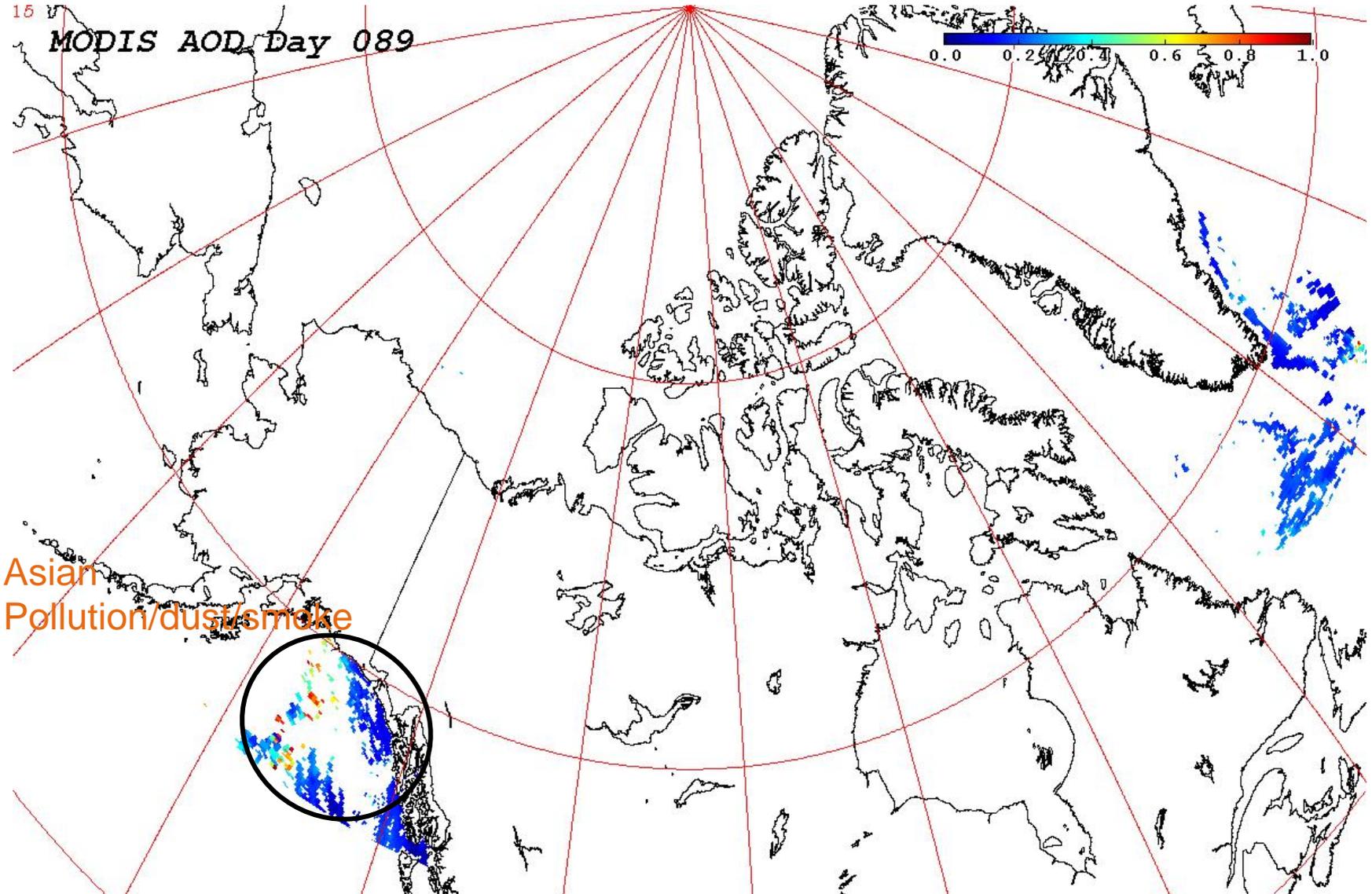
CONTACT: Dr. Juying Warner <juying@umbc.edu>; ACKNOWLEDGEMENT: AIRS NRT products by NASA DAAC

MODIS AOD Hot Spots in Northern Hemisphere (0° - 90°N)

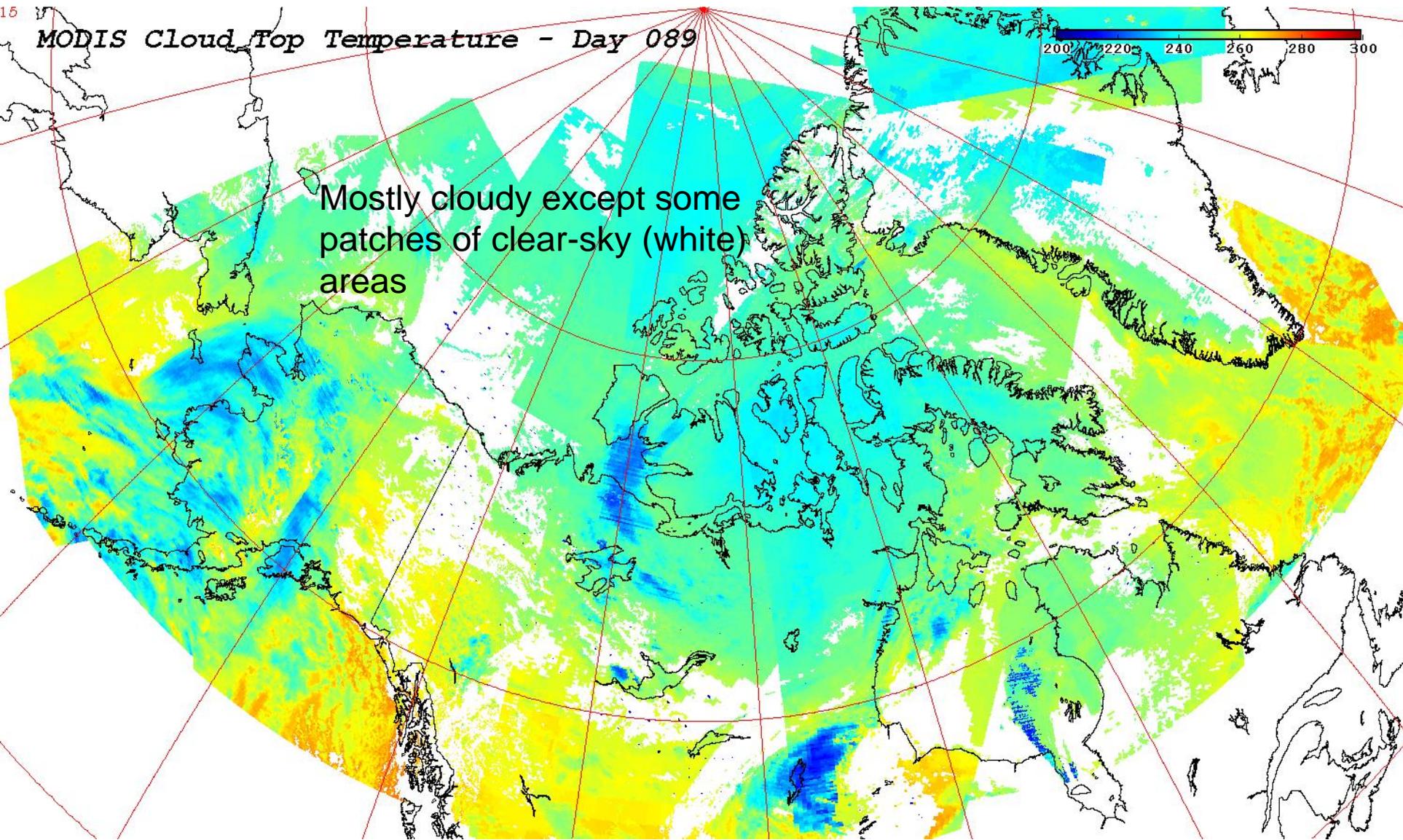
MODIS AOD Day 089



MODIS AOD Hot Spots in Flight Domain



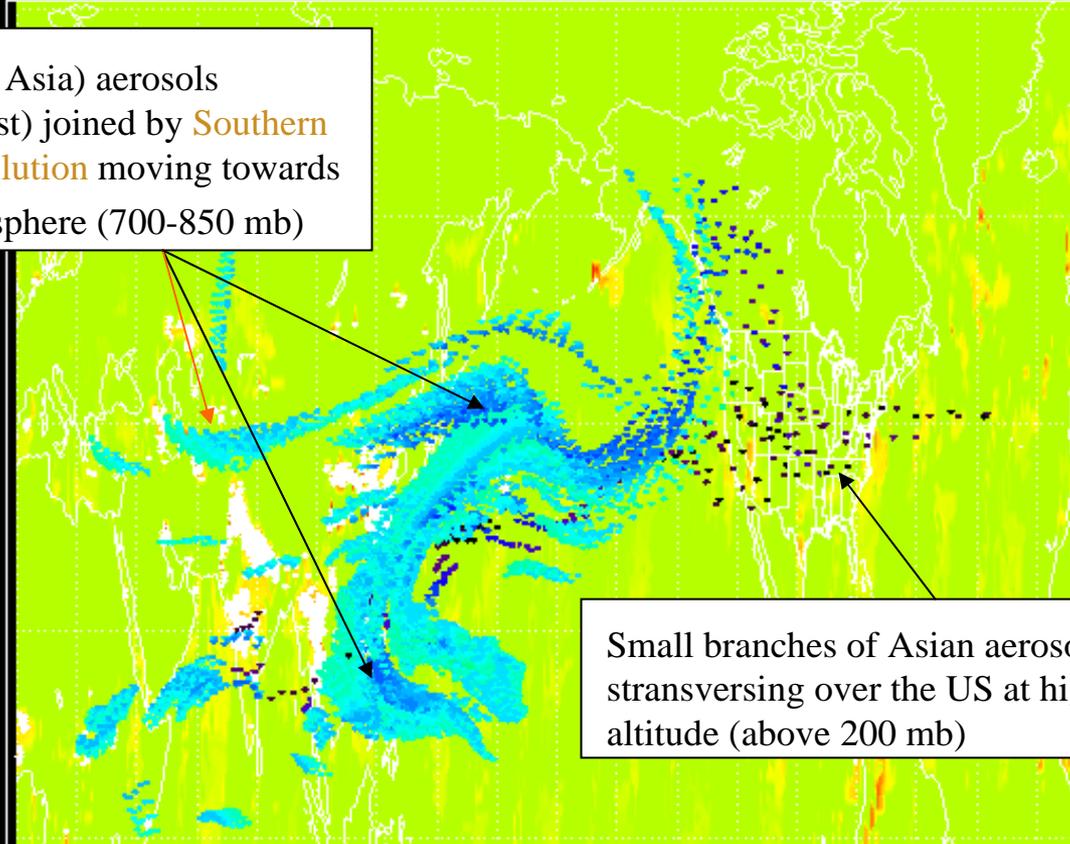
MODIS Cloud Top Temperature in Flight Domain



Aerosol Trajectory Based Upon MODIS AOD and GEOS-5 Winds

MODIS BL Trajectories initialized 2008032700 Valid 2008033118

Asian (including SE Asia) aerosols
(pollution/smoke/dust) joined by **Southern
European smoke/pollution** moving towards
Alaska in mid-atmosphere (700-850 mb)



Small branches of Asian aerosols
stransversing over the US at high
altitude (above 200 mb)

0.0 0.2 0.4 0.6 0.8 1.0
AOD

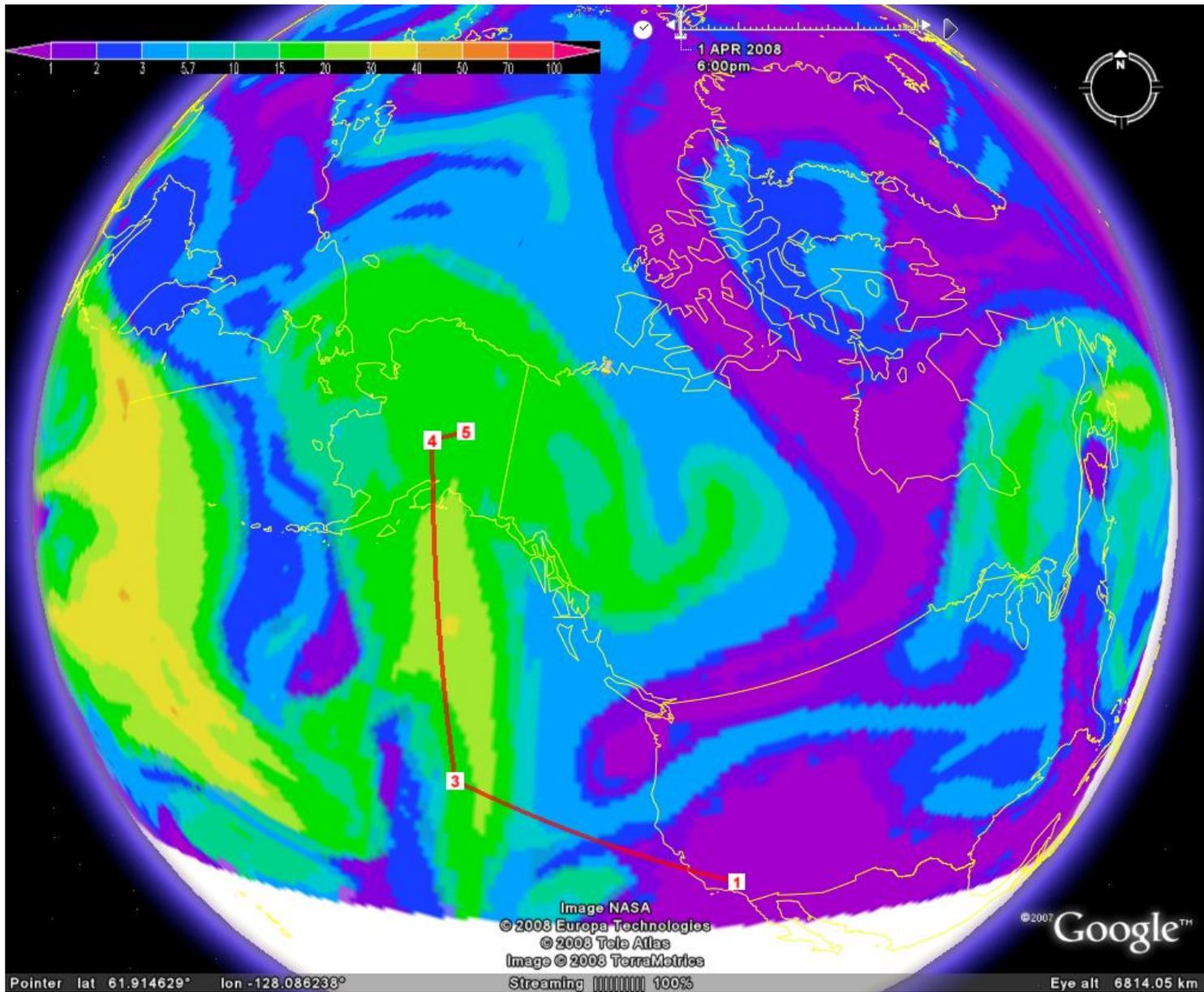
200 400 600 800 1000
Pressure (mb)

(Courtesy: Brad Pierce & Duncan Fairlei for Trajectory Package)

University of Iowa STEM Model

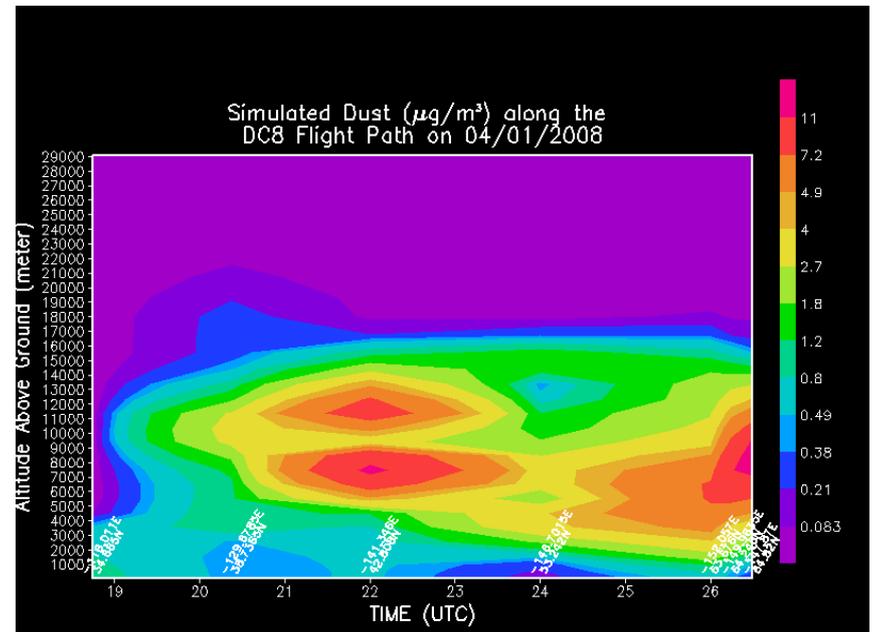
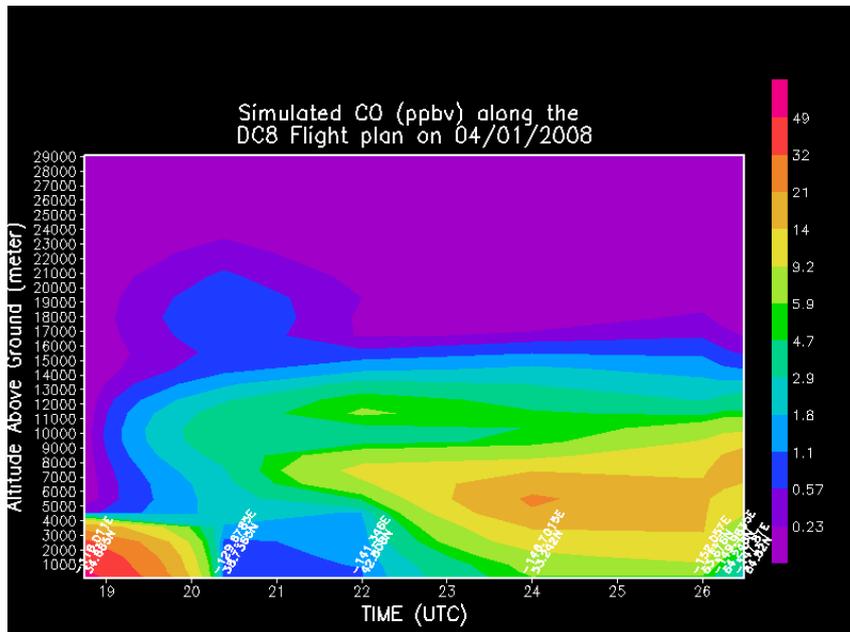
Flight planning meeting

03-30-2008



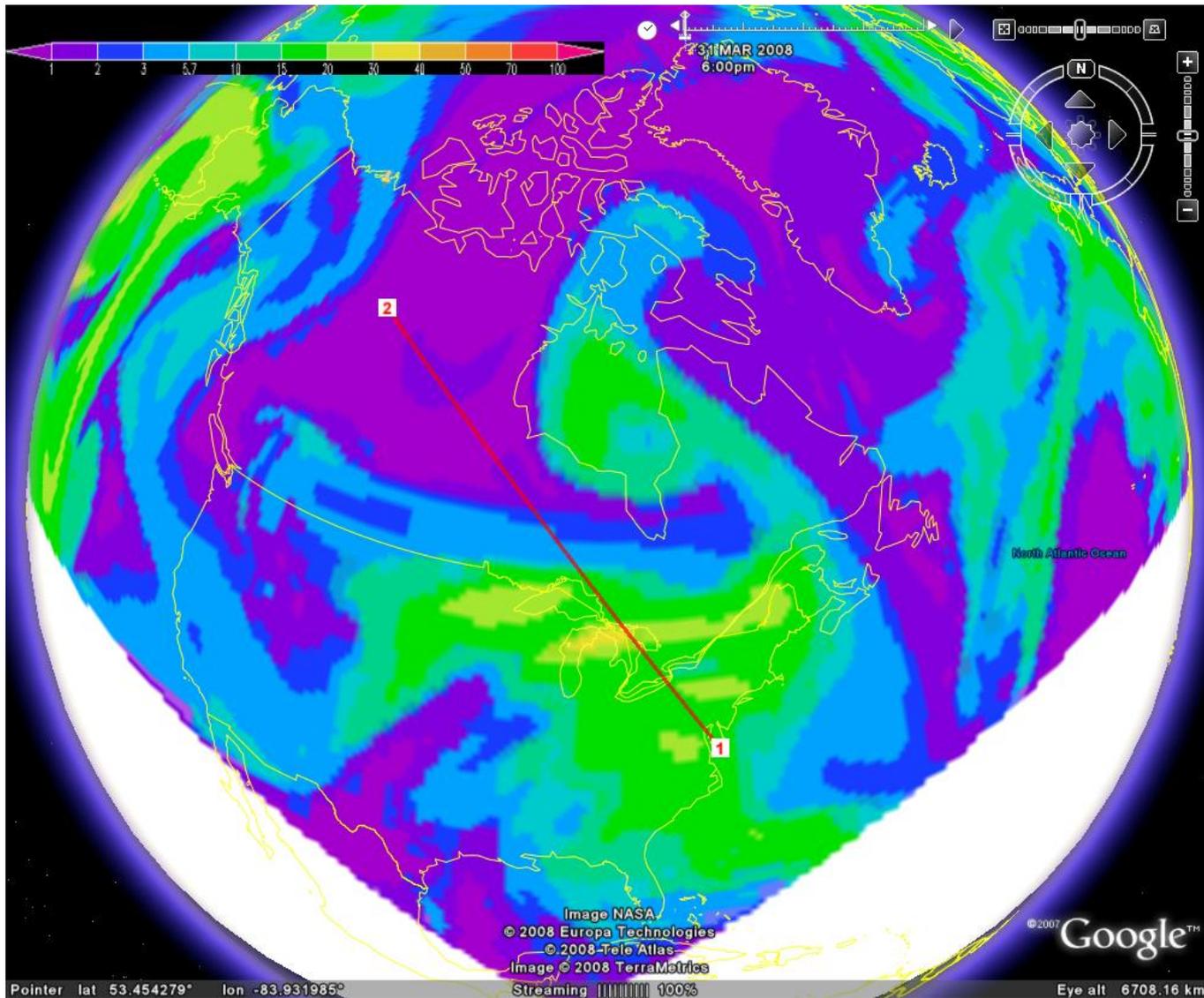
Anthropogenic CO₂, at 8.4 km, 18Z (April 1) , STEM model 66 hr forecast

DC8 April 1 curtain



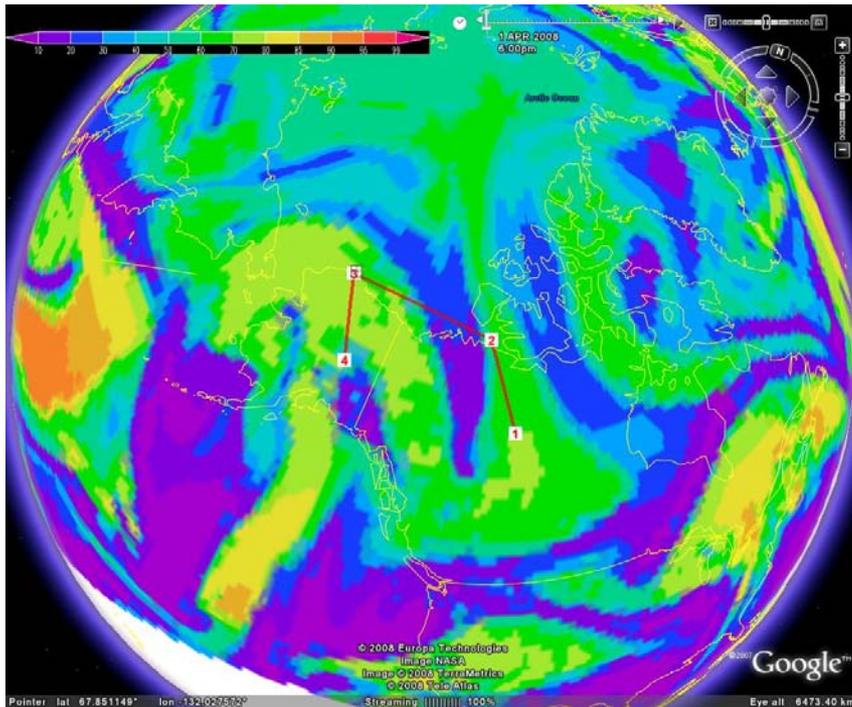
USA Asia
 Biomass China Europe

Along the flight path we see air masses from different source regions

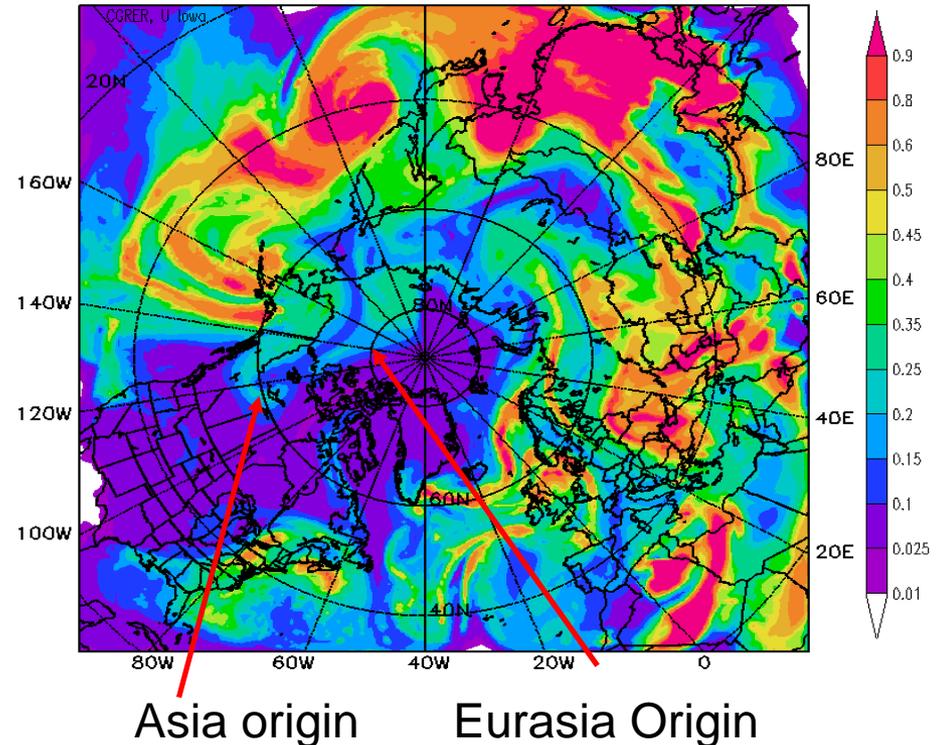


Anthropogenic CO₂, 5.5 km layer, 18Z 31st March,
Expect to see some N America biomass and pollution.

April 1 flight for P3



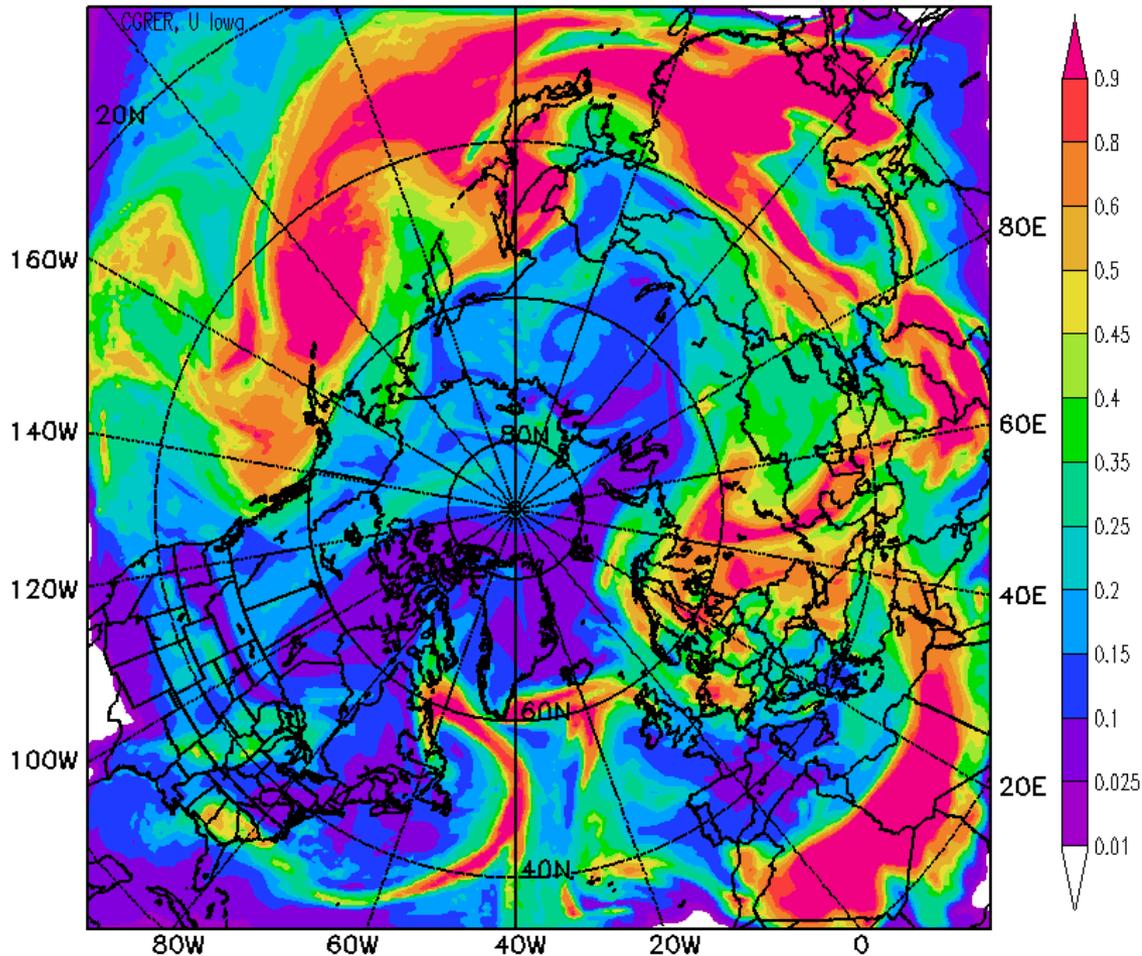
Simulated Column TOTAL_Aerosol_Optical_Depth
at 18UTC, 4/1/2008



Left panel: RH at 5.5 KM, 18Z on April 1. Right panel: Total AOD.
Area of enhanced AOD south of Pt 2 (70 N, 120 W) is of Asia origin.
Leg from 1-2 encounters air of EurAsia origin. Area of low RH between
pts 2-3. Estimated flight time is 5.5 hours (room for spirals).

DC8 outlook for April 3

Simulated Column TOTAL_Aerosol_Optical_Depth
at 18UTC, 4/3/2008

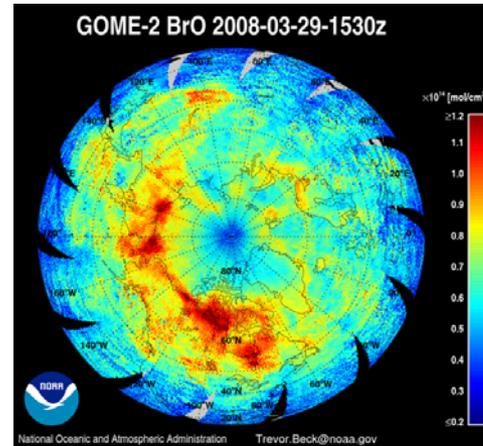
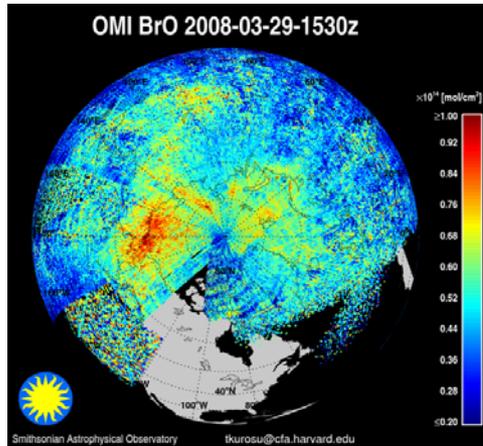


- 114 hour forecast

- From Fairbanks to Thule we expect to see elevated AOD from pollution of differing origin.

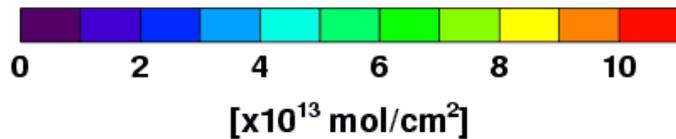
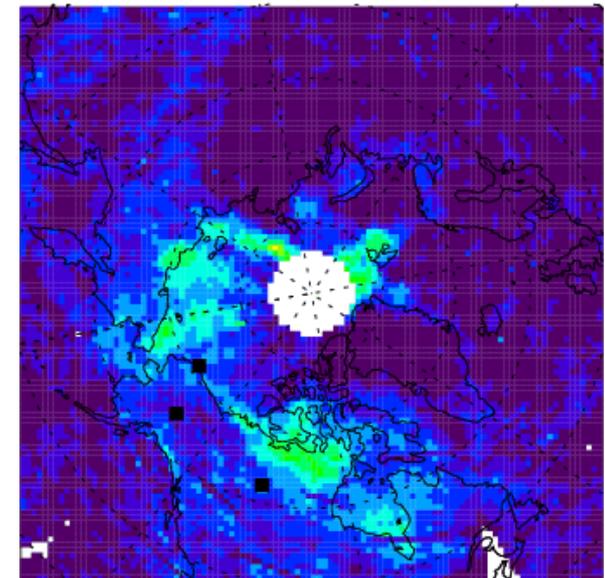
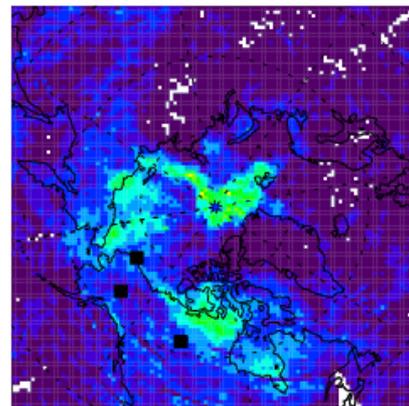
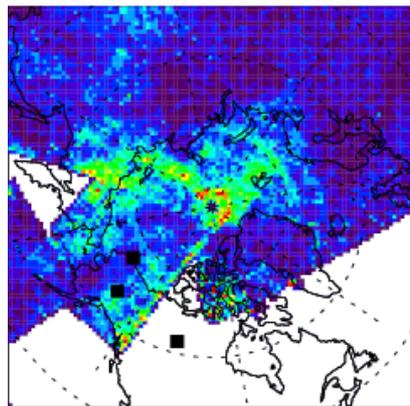
- Longitudinal gradient of Asian, European, and North American air-masses.

Total BrO columns



Merged BrO VCD as model input

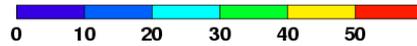
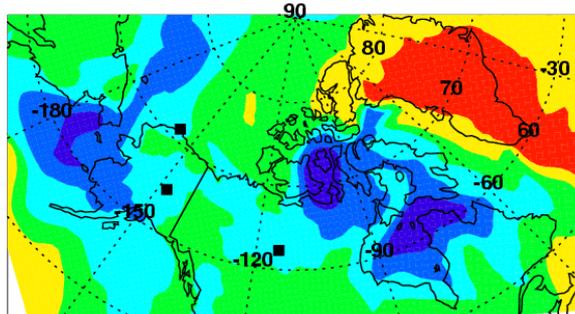
Boundary BrO columns



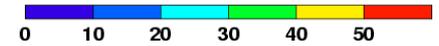
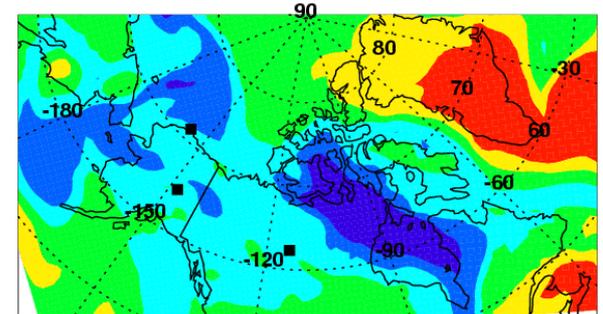
Surface Ozone forecast at noon in 4 days

BrO on March, 29

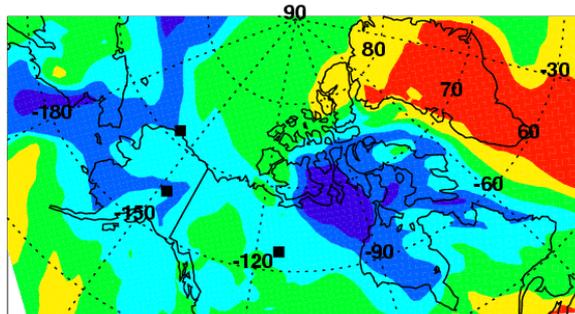
O₃ (ppbv) at surface, Mar-30_2000 UTC



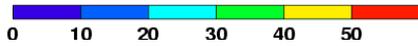
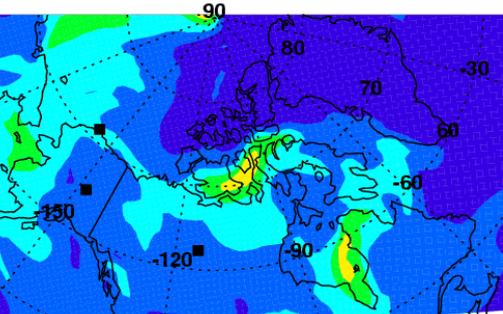
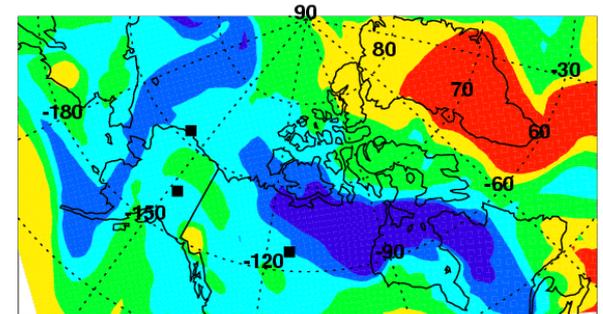
O₃ (ppbv) at surface, Apr-01_2000 UTC



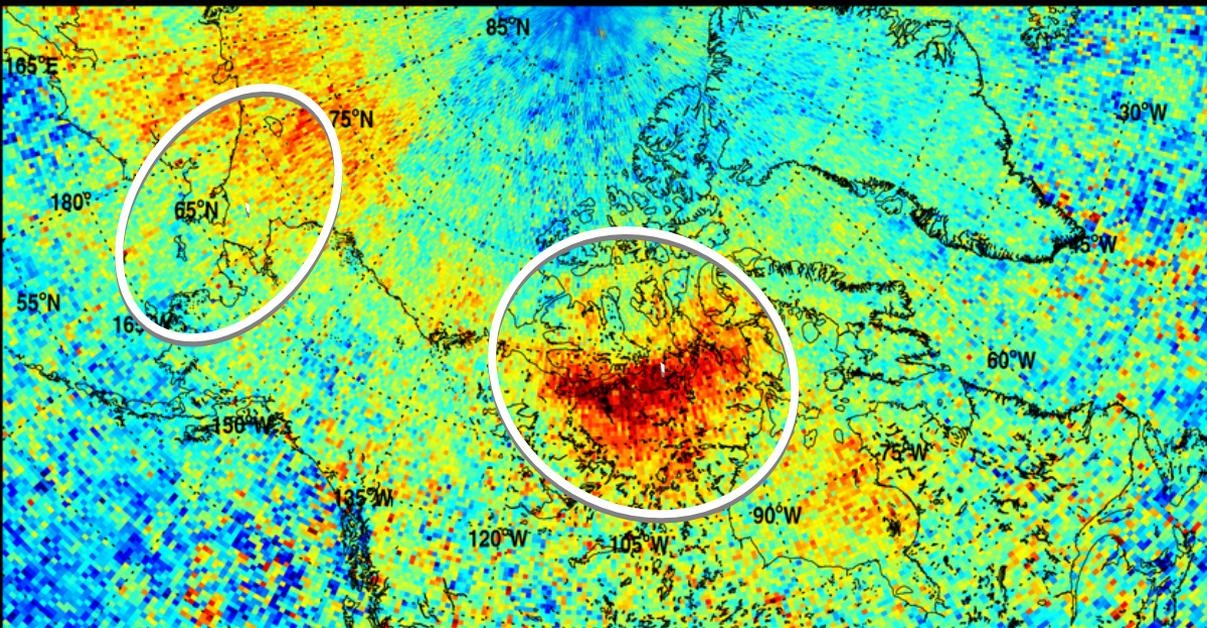
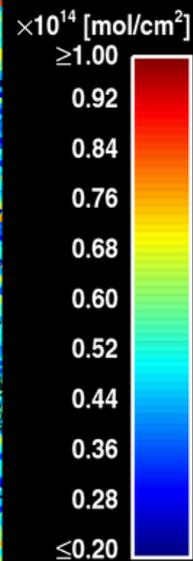
O₃ (ppbv) at surface, Mar-31_2000 UTC



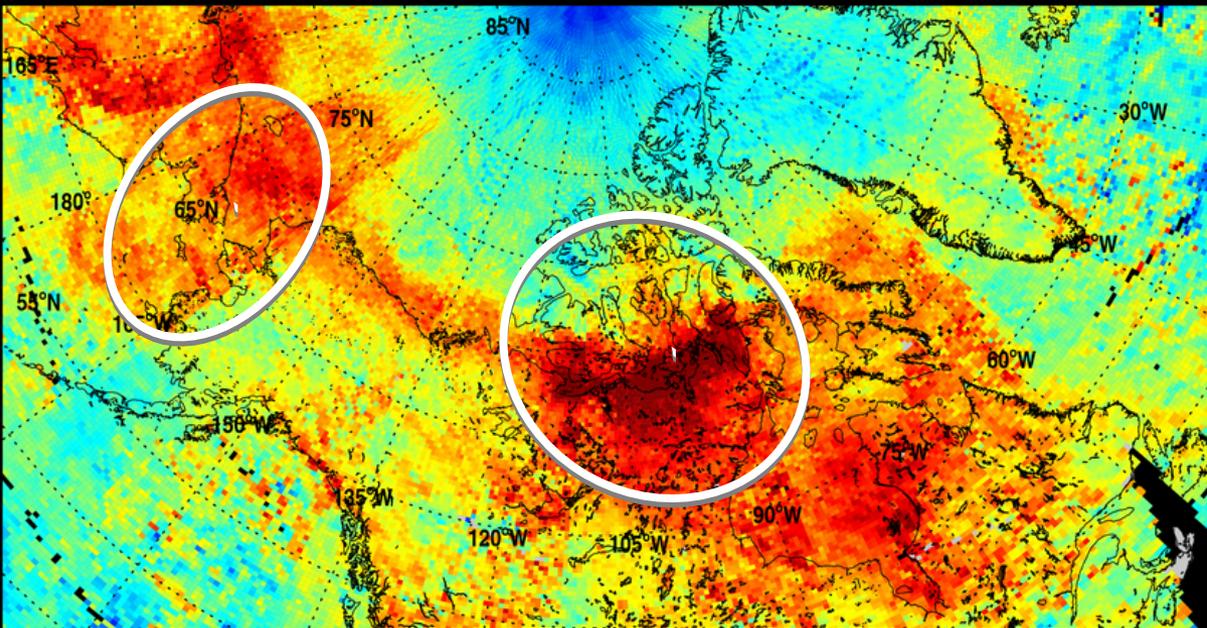
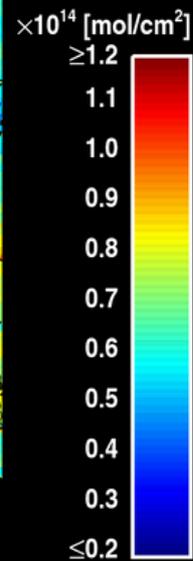
O₃ (ppbv) at surface, Apr-02_2000 UTC



OMI BrO 2008-03-30-1530z



GOME-2 BrO 2008-03-30-1530z

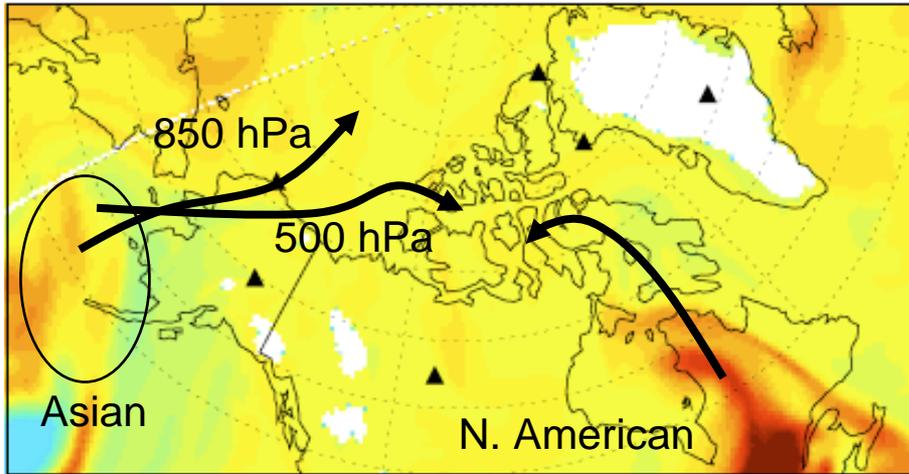


BrO columns have decreased since 3/28

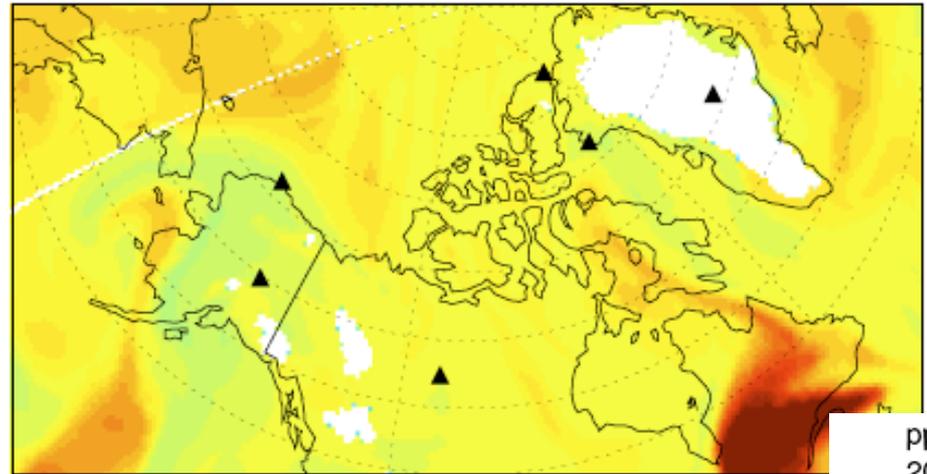
Bering Strait and Queen Elizabeth Islands

GEOS Total CO 850 hPa

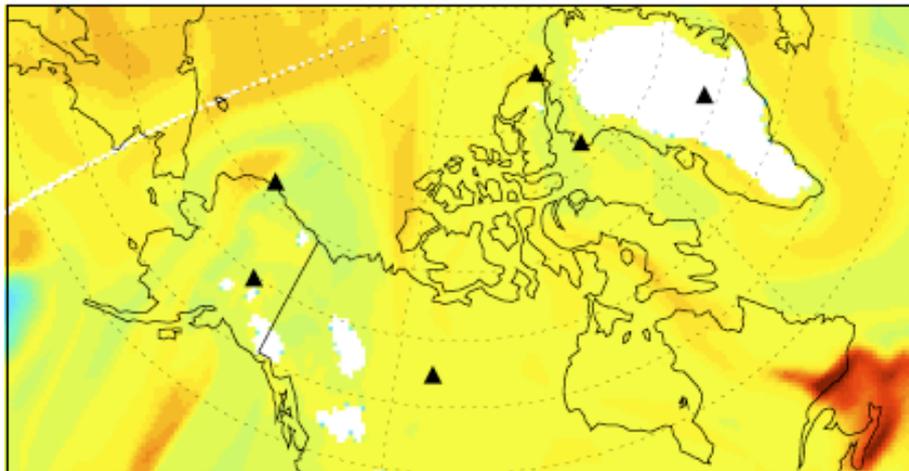
3/31



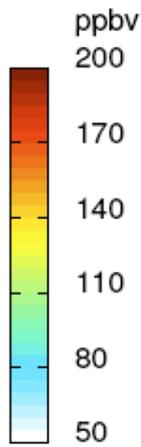
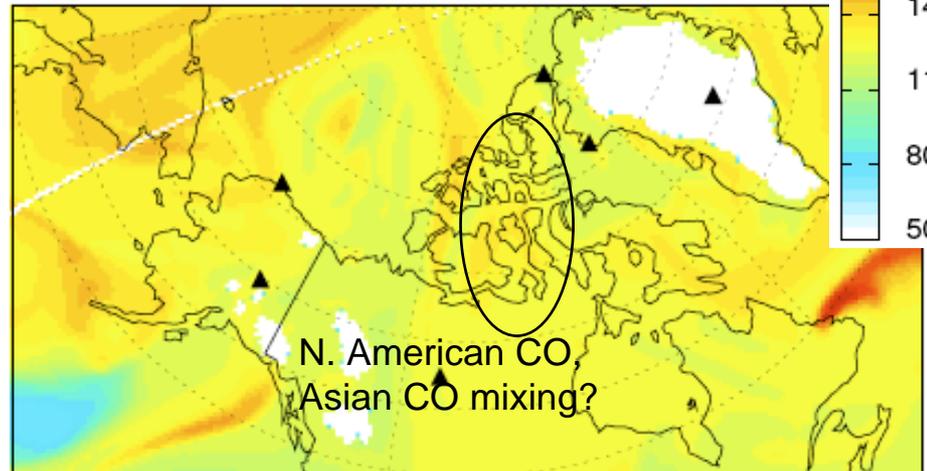
4/1



4/2



4/3



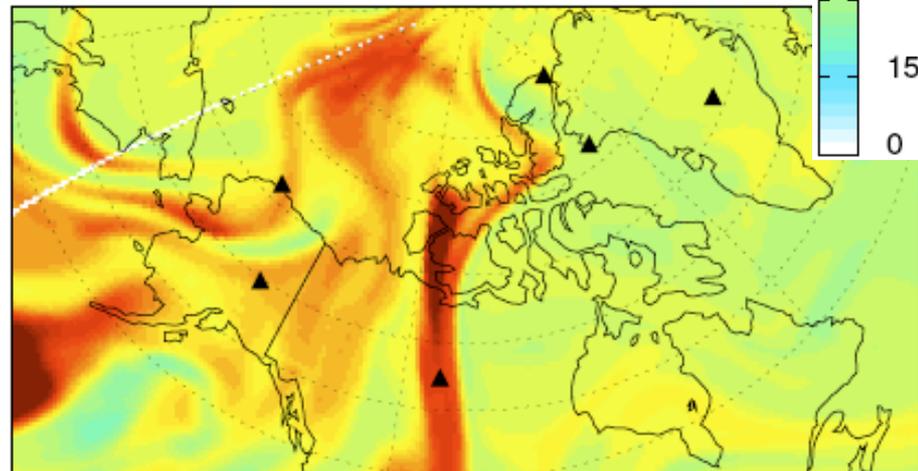
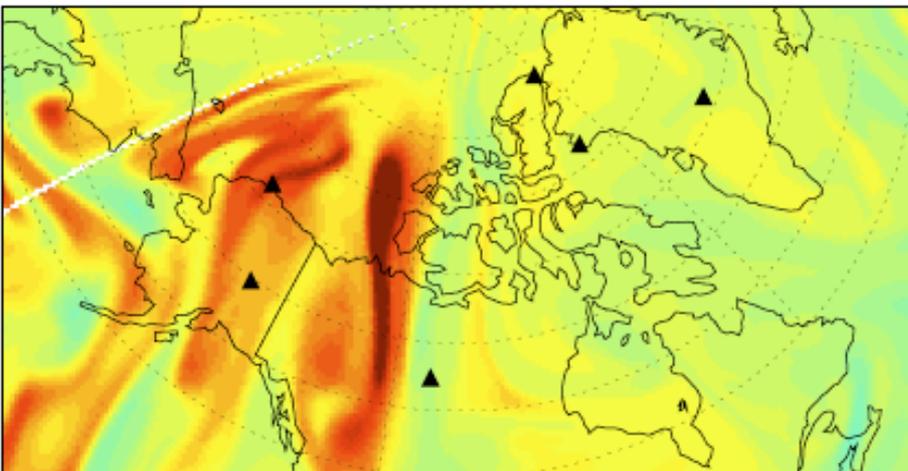
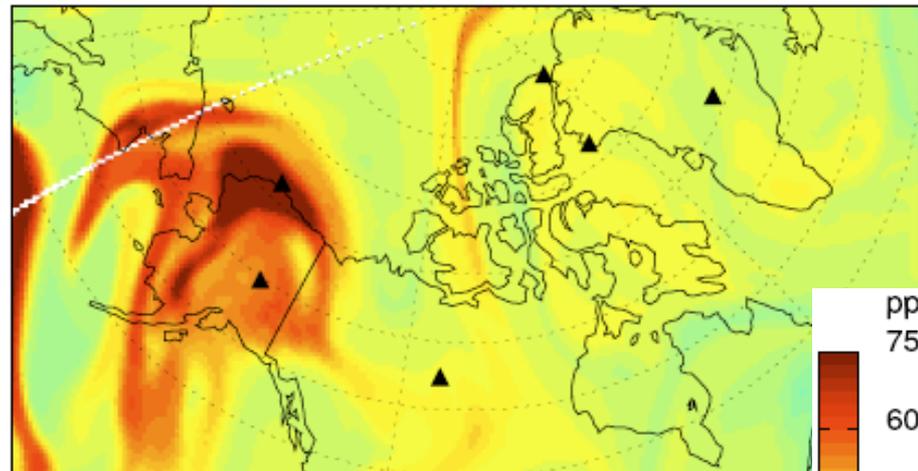
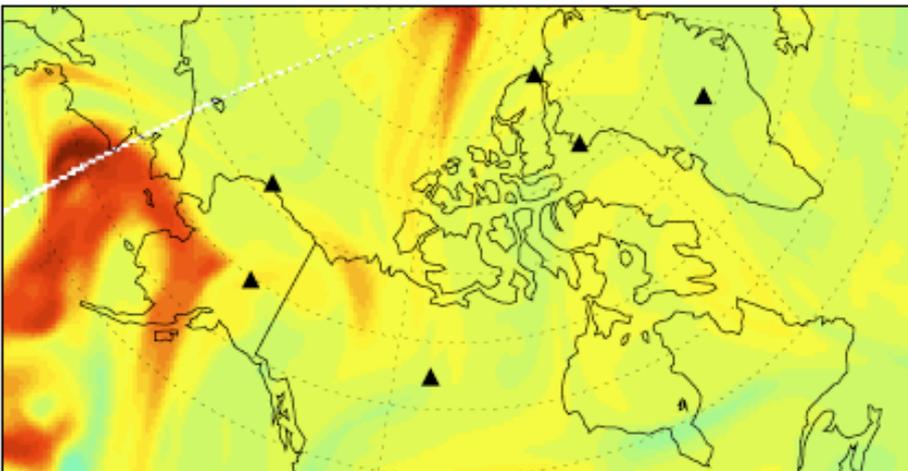
GEOS Asian CO 500 hPa

3/31

4/1

4/2

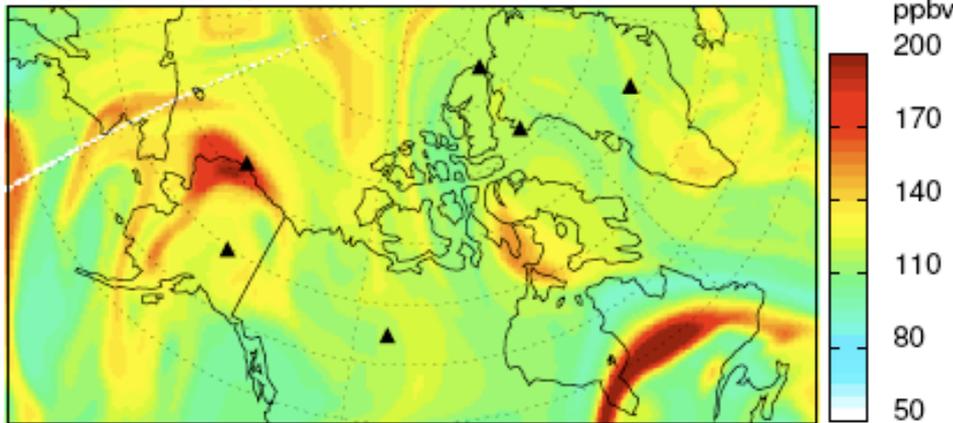
4/3



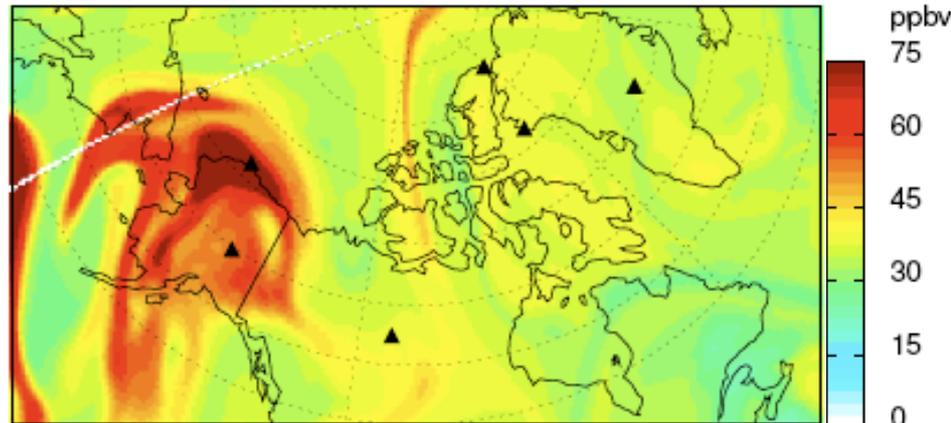
Initialized 03/30/2008 – 06z

Asian pollution over Barrow on 4/01 - P3 Flight Opportunity?

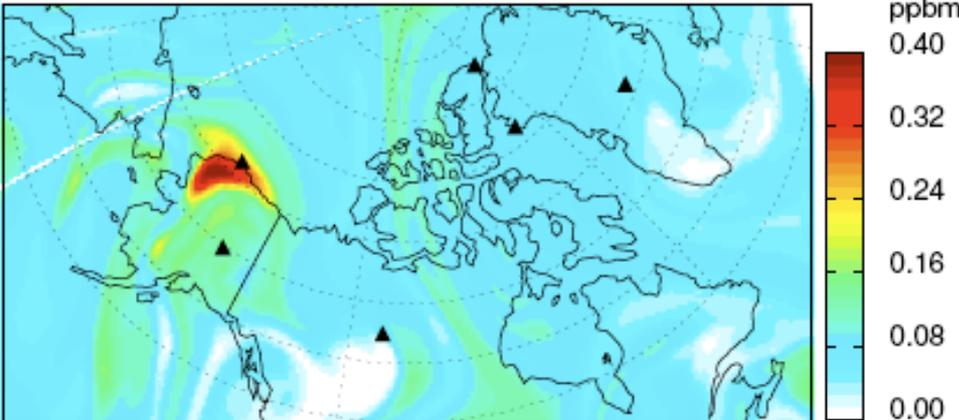
Total CO



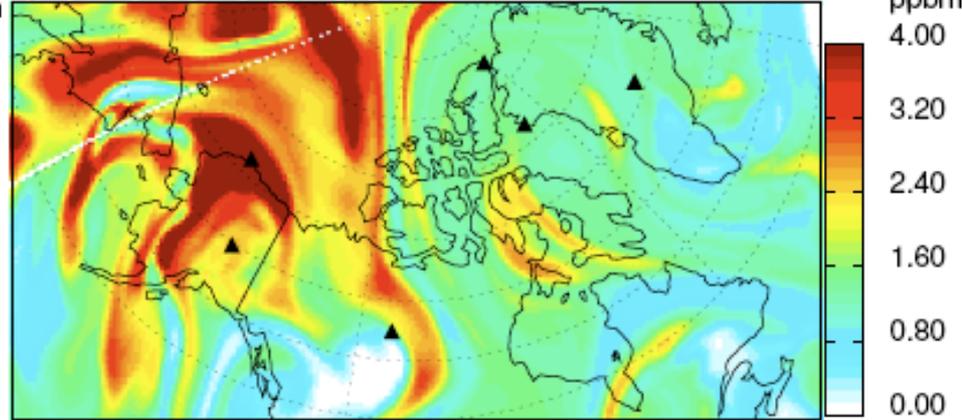
Asian CO



Black Carbon

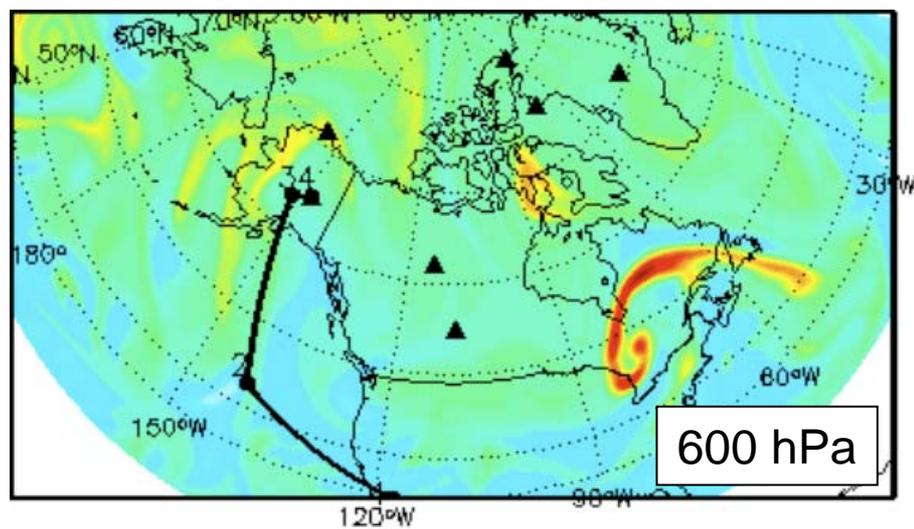
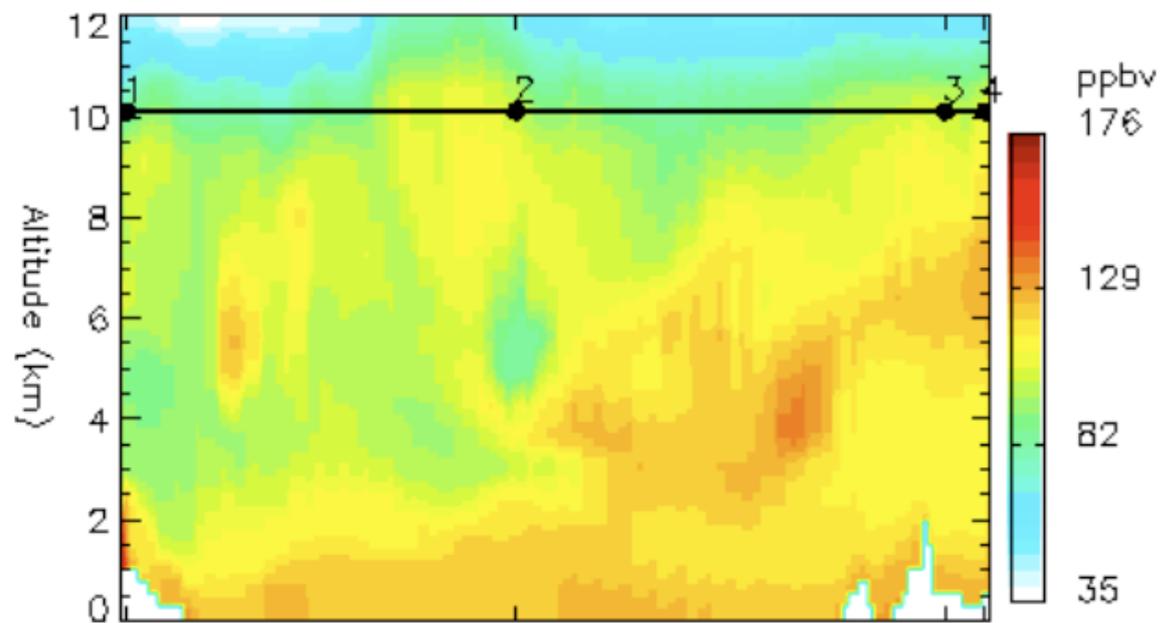


Sulfate aerosol



All 500 hPa

CO along proposed DC8 flight track



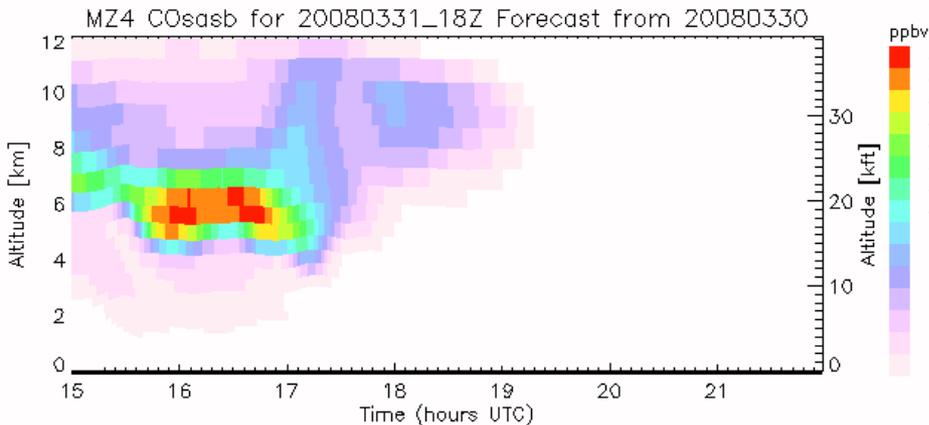
Initialized 03/30/2008 - 06Z

Mar 31 P-3 Wallops to Yellowknife

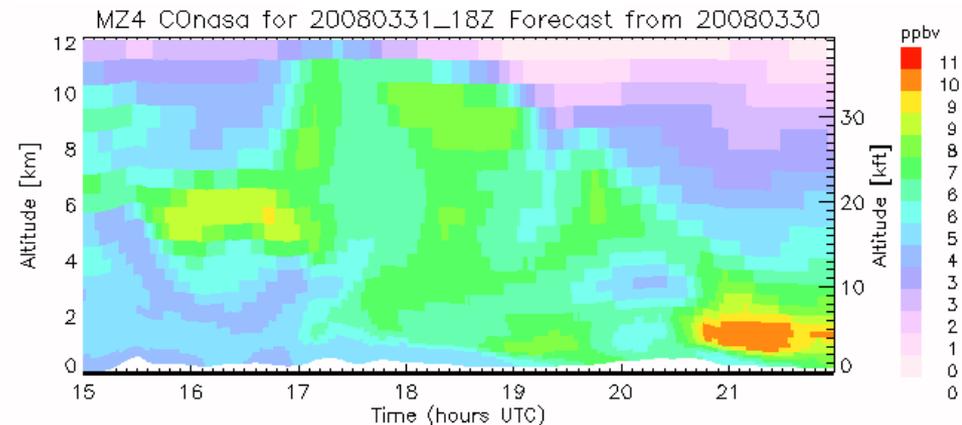
MOZART-4/GFS forecasts from Mar 30 for Mar 31 18Z

- Biomass burning plume from S. Asia at 6 km over Great Lakes
- N.Asia anthro plume at low alts on approach to Yellowknife

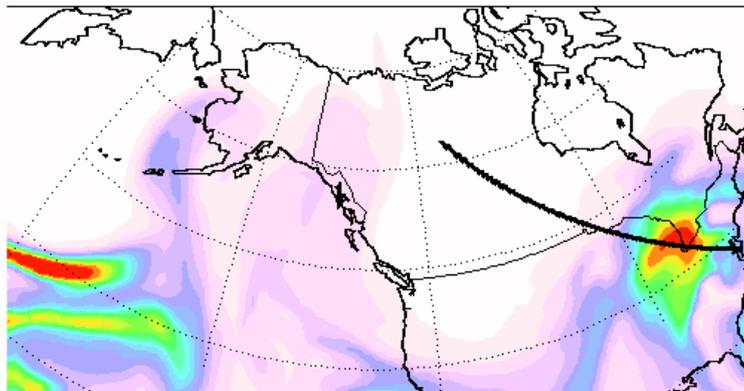
S.Asia Fires



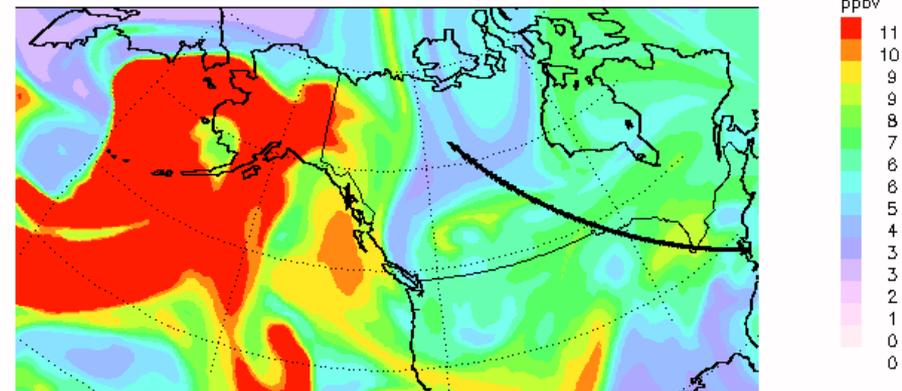
N.Asia Anthro



CO_{asb} 6 km 20080331_18Z



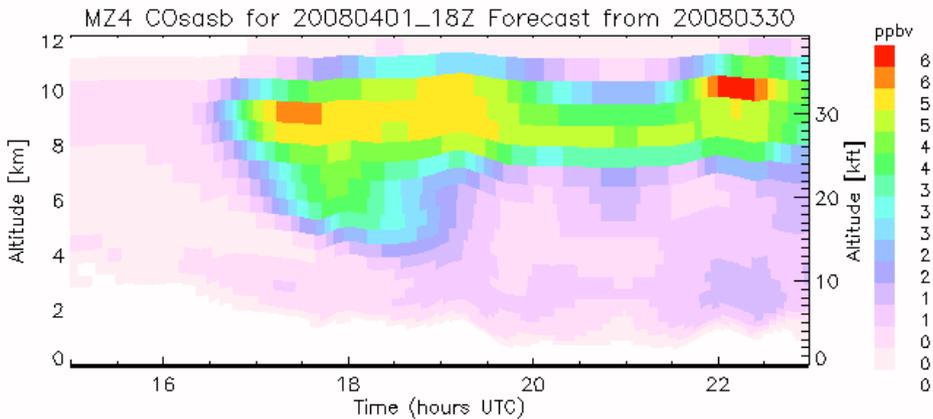
CO_{nasa} 6 km 20080331_18Z



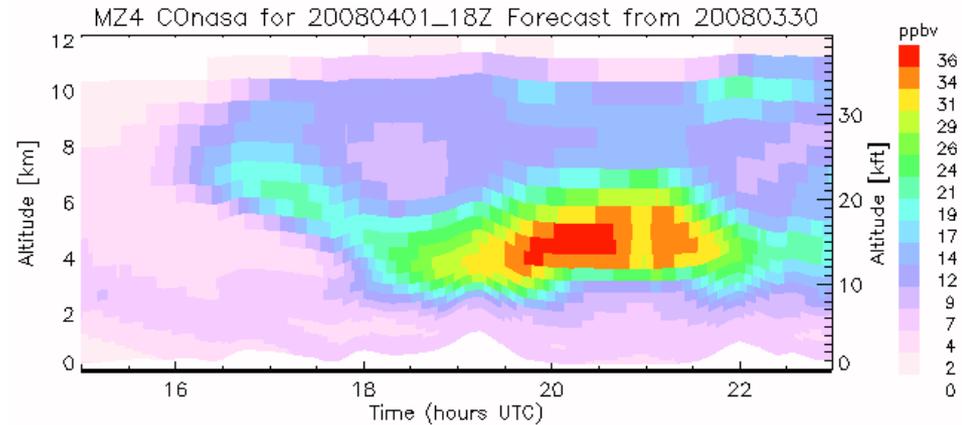
Apr 1 P-3 Yellowknife to Fairbanks via Barrow MOZART-4/GFS forecasts from Mar 30 for Mar 31 18Z

- Biomass burning plume from S. Asia at altitude on transit to Barrow
- Anthro Asian pollution 4-6 km over Barrow

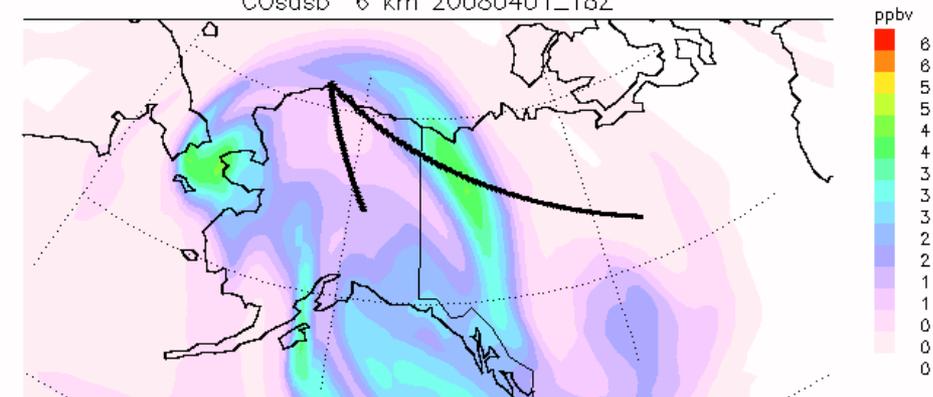
S.Asia Fires



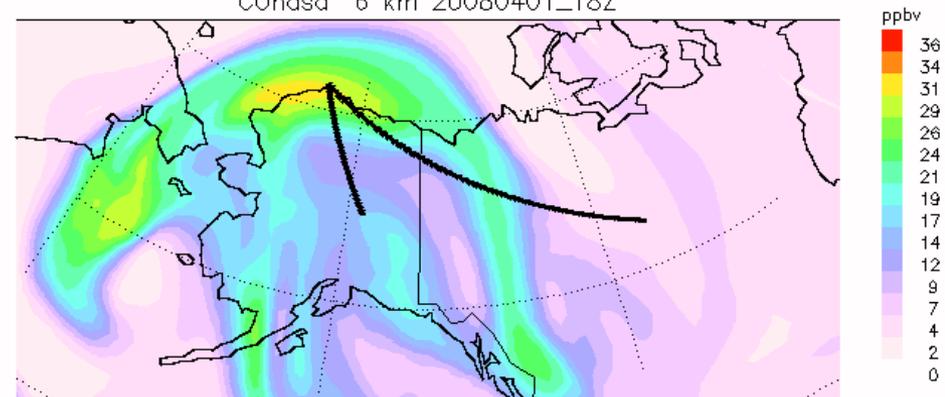
N.Asia Anthro



CO_{sasb} 6 km 20080401_18Z



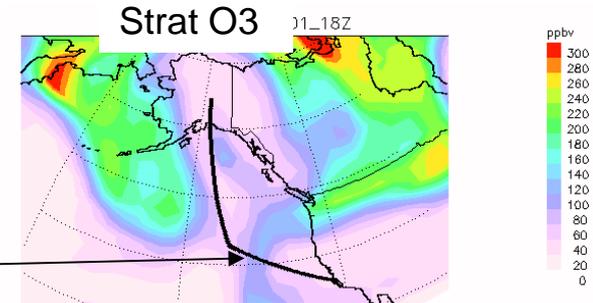
CO_{nasa} 6 km 20080401_18Z



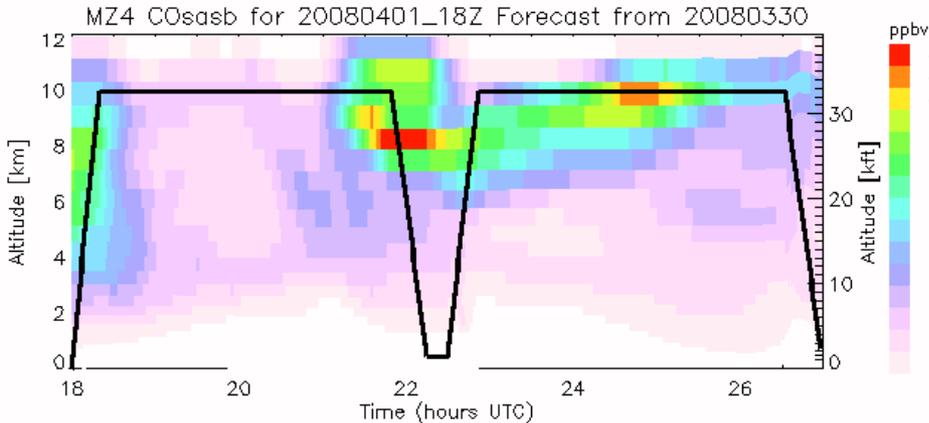
Apr 1 DC-8 Palmdale to Fairbanks

MOZART-4/GFS forecasts from Mar 30 for Mar 31 18Z

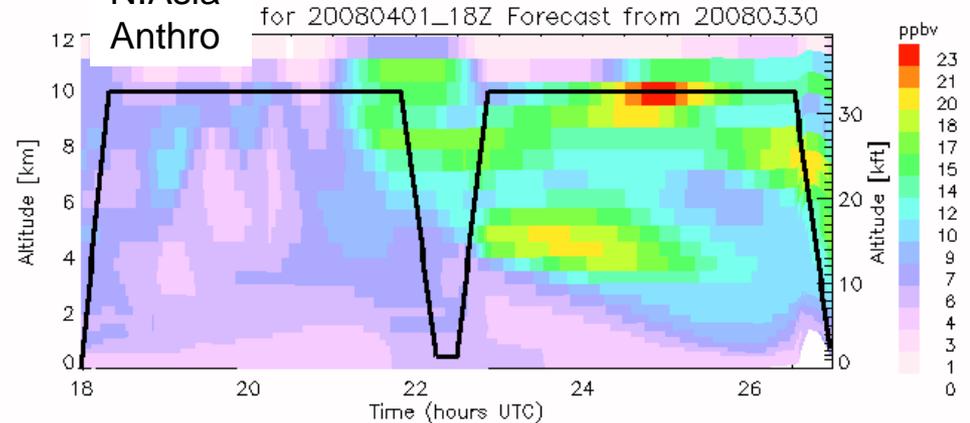
- May encounter biomass burning plume from S. Asia on spiral and on north leg
- N.Asia and S. Asia anthro mixed in
- Weak Strat O3 intrusion on first leg



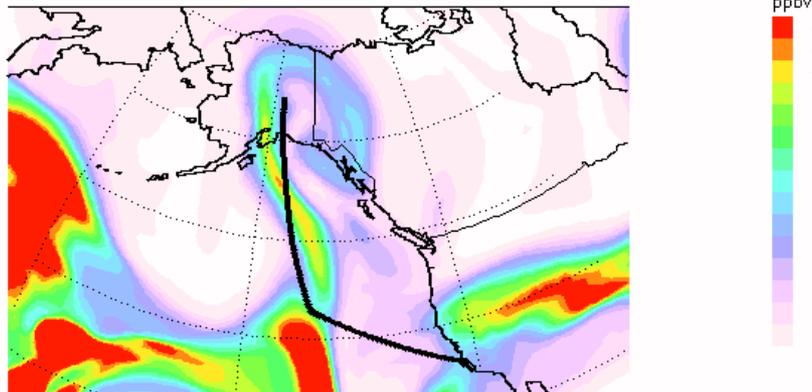
S.Asia Fires



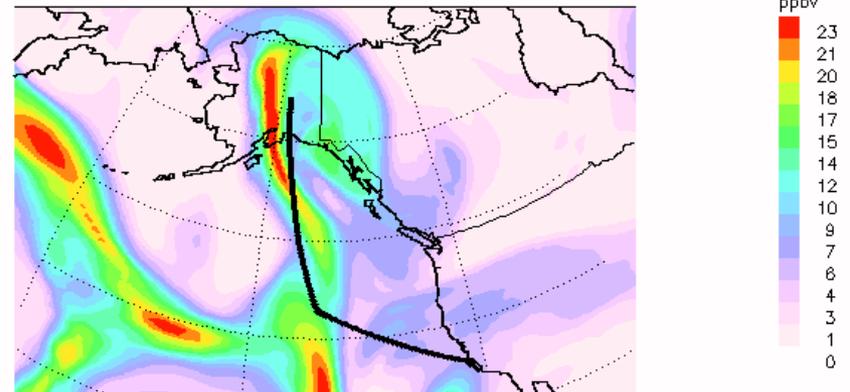
N.Asia Anthro



COsasb 10 km 20080401_18Z

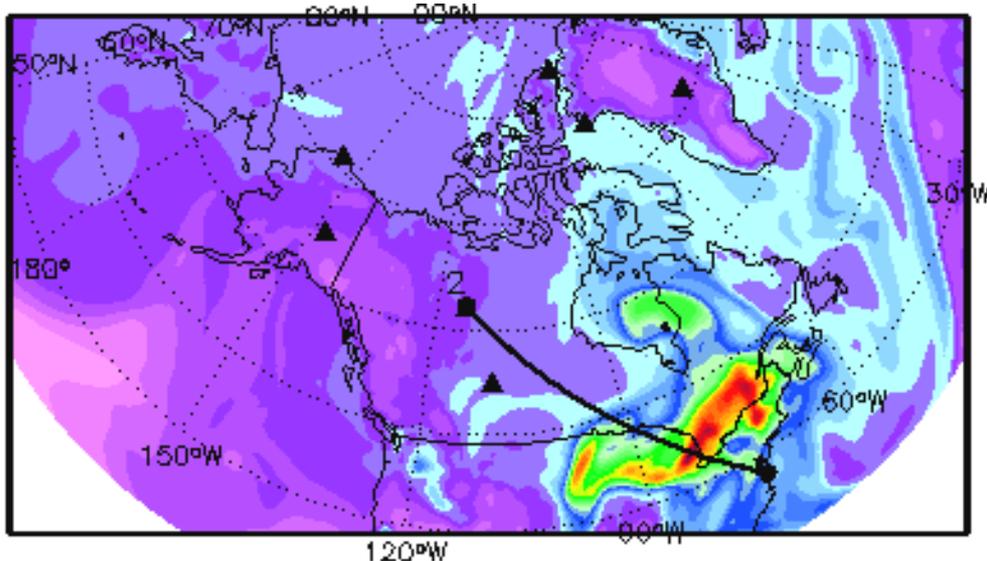


COnasa 10 km 20080401_18Z

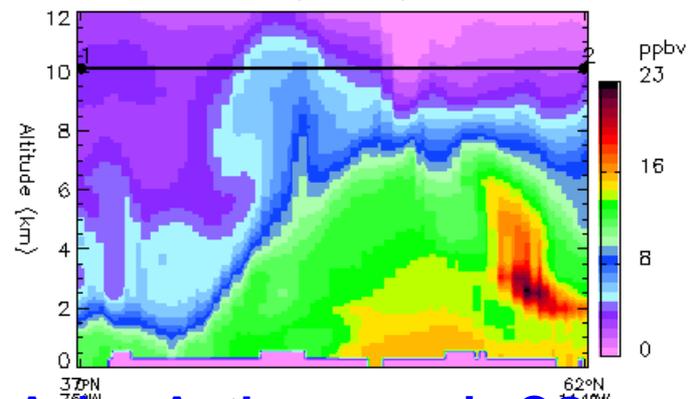


GEOS-5 CO forecasts
forecast from 20080330_06Z

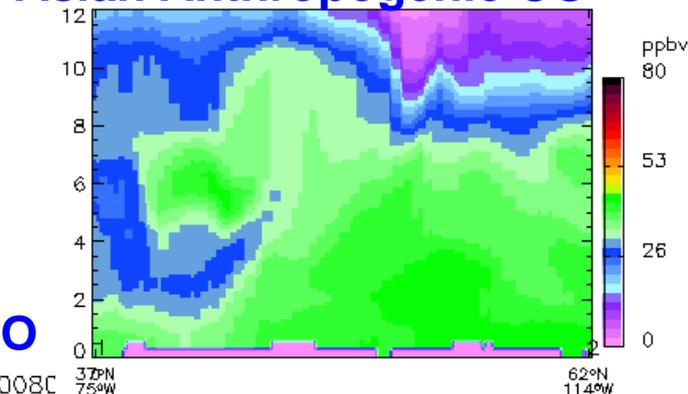
Wallops to Yellowknife 3/31



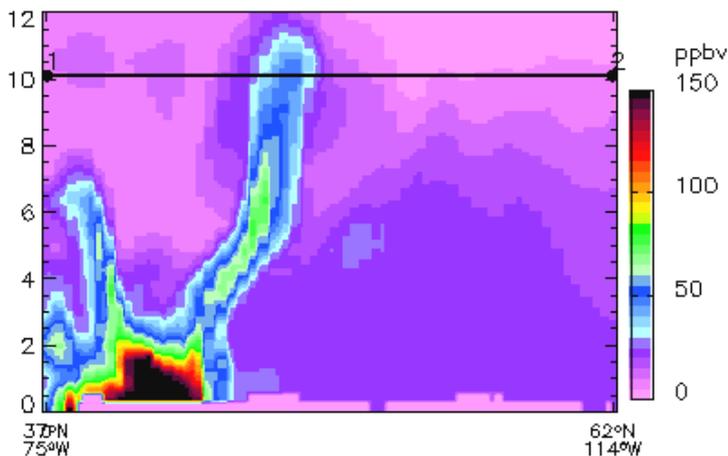
European Anthropogenic CO



Asian Anthropogenic CO

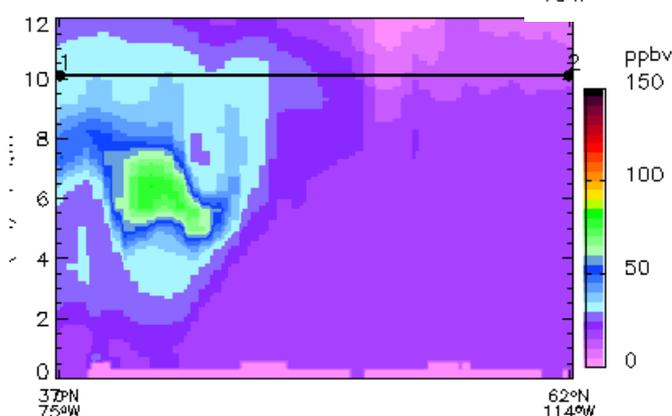


N. American Anthropogenic CO



Non-Boreal BB CO

Curtain plot
- NON-BOREAL BIOMASS BURNING 2008C



Yellowknife to Fairbanks 4/1

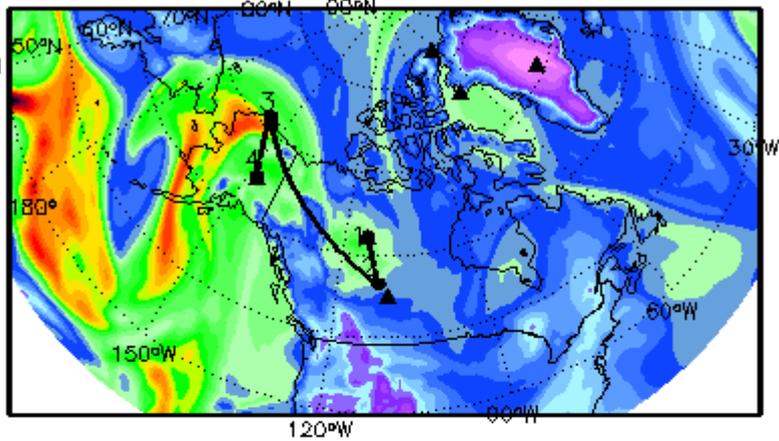
Asian Anthropogenic CO

GEOS-5 forecast: 20080330_06z

Asian Biomass Burning CO

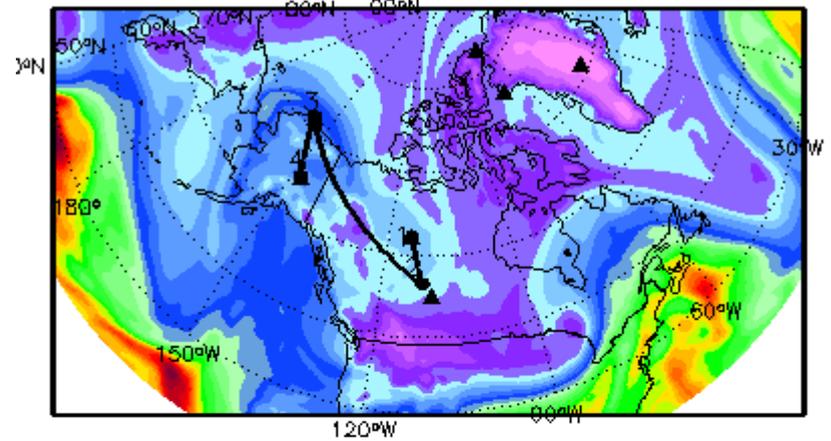
GEOS-5 forecast: 20080330_06z

CO COLUMN BURDEN (ASIA ANTHROPOGENIC)
20080401 16:30Z



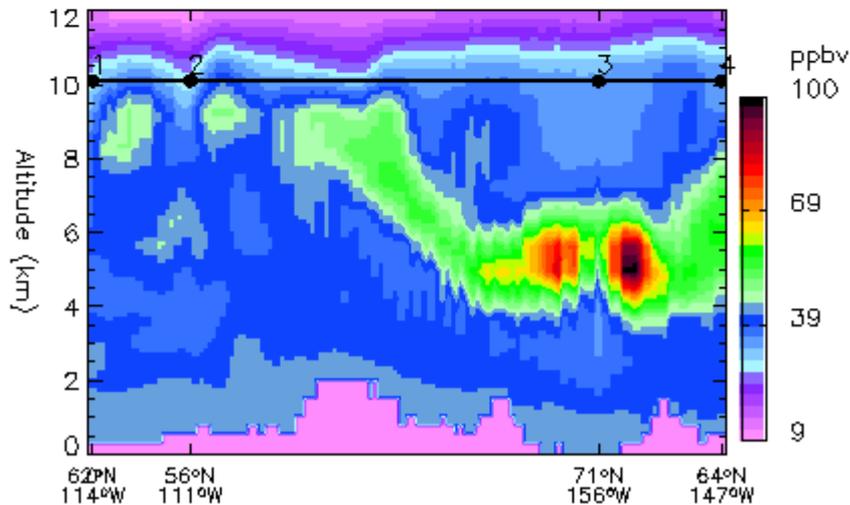
1.30e-04 2.11e-04 2.92e-04 3.73e-04 4.54e-04 5.35e-04 kg/m²

CO COLUMN BURDEN (NON-BOREAL BIOMASS BURNING)
20080401 16:30Z

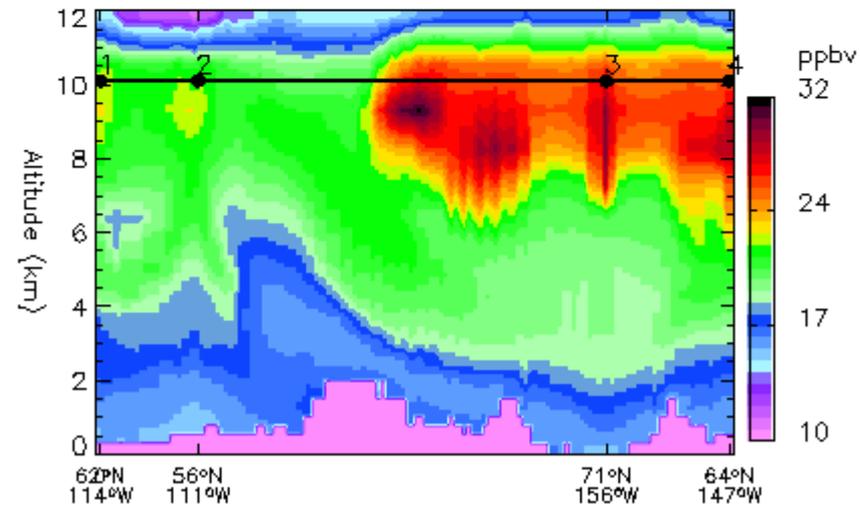


8.49e-05 1.41e-04 1.97e-04 2.53e-04 3.09e-04 3.65e-04 kg/m²

Curtain plot
CO - ANTHOPOGENIC (ASIA) 20080401 16:30Z



Curtain plot
CO - NON-BOREAL BIOMASS BURNING 20080401 16:30Z

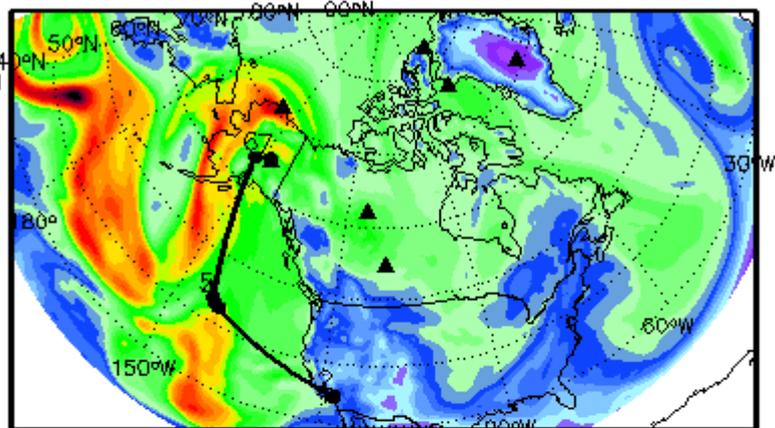


Palmdale to Fairbanks 4/1

Asian Anthropogenic CO

GEOS-5 forecast: 20080330_06z

CO COLUMN BURDEN (ASIA ANTHROPOGENIC)
20080401 19:30Z

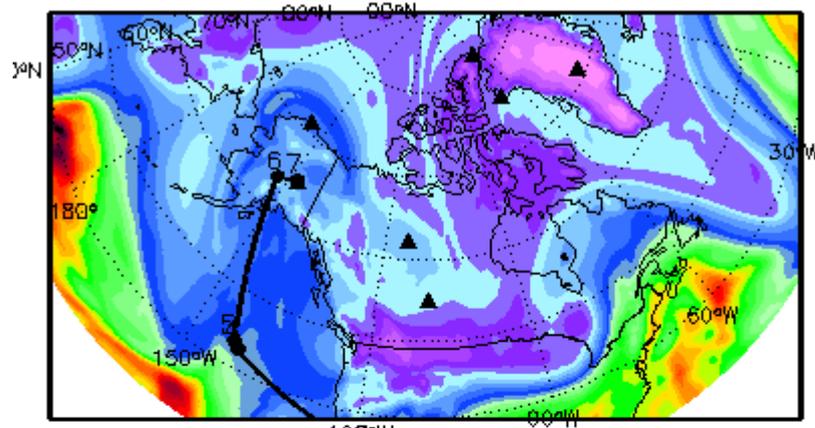


7.82e-05 1.69e-04 2.59e-04 3.50e-04 4.41e-04 5.31e-04 kg/m²

Non-Boreal Biomass Burning CO

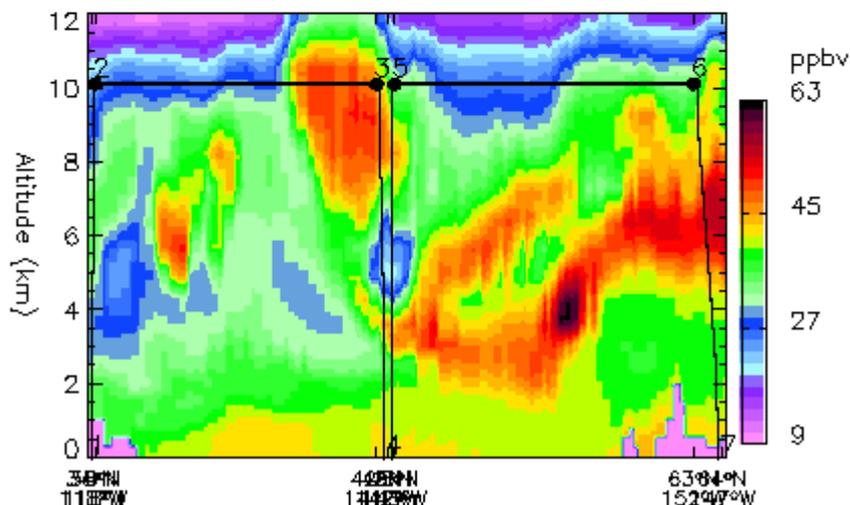
GEOS-5 forecast: 20080330_06z

CO COLUMN BURDEN (NON-BOREAL BIOMASS BURNING)
20080401 19:30Z

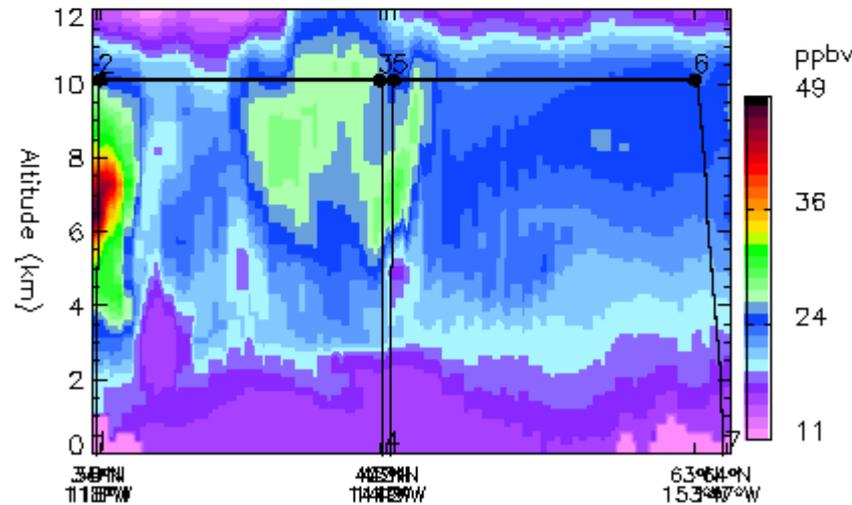


8.49e-05 1.40e-04 1.96e-04 2.52e-04 3.07e-04 3.63e-04 kg/m²

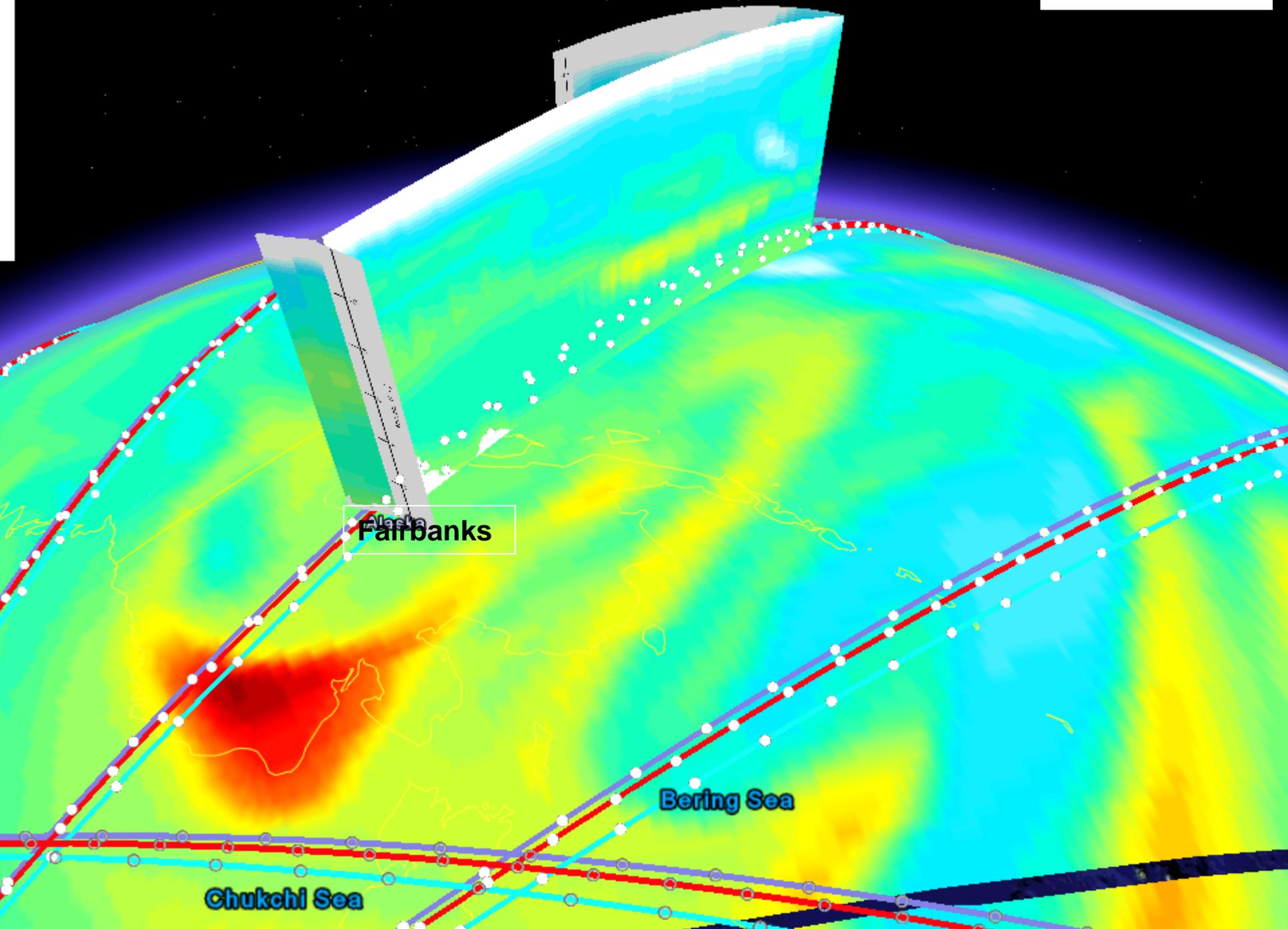
Curtain plot
CO - ANTHOPOGENIC (ASIA) 20080401 19:30Z



Curtain plot
CO - NON-BOREAL BIOMASS BURNING 20080401 19:30Z



Total CO₂

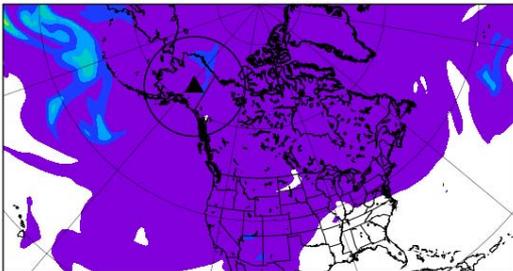


Alaska
Fairbanks

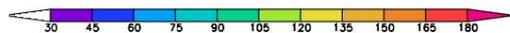
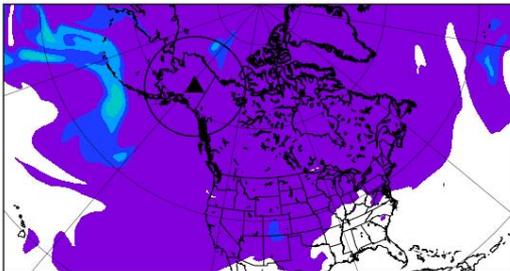
Bering Sea

Chukchi Sea

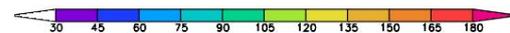
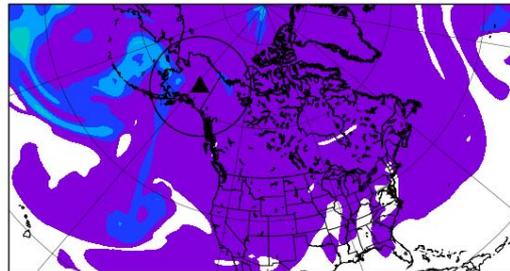
CO @ 500hPa (non-Russia Asian fossil fuel sources) [ppbV]
07:30Z30MAR2008



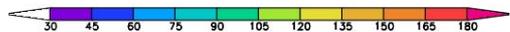
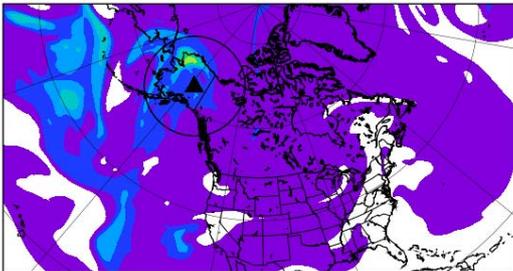
CO @ 500hPa (non-Russia Asian fossil fuel sources) [ppbV]
16:30Z30MAR2008



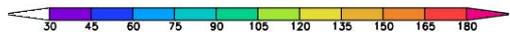
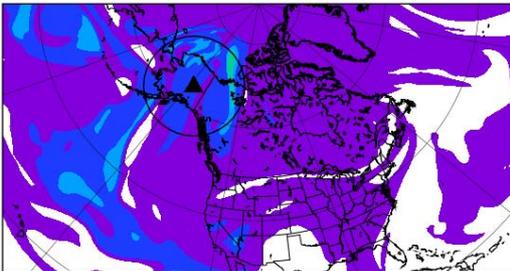
CO @ 500hPa (non-Russia Asian fossil fuel sources) [ppbV]
16:30Z31MAR2008



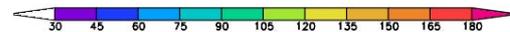
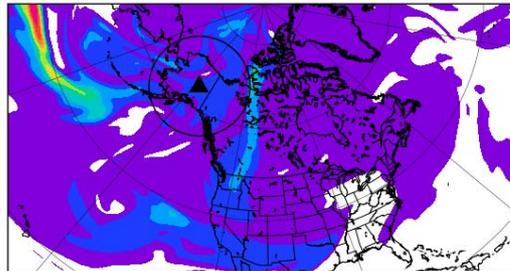
CO @ 500hPa (non-Russia Asian fossil fuel sources) [ppbV]
16:30Z01APR2008



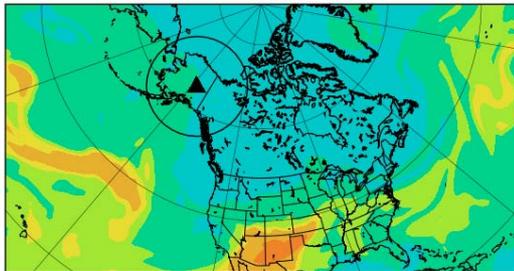
CO @ 500hPa (non-Russia Asian fossil fuel sources) [ppbV]
16:30Z02APR2008



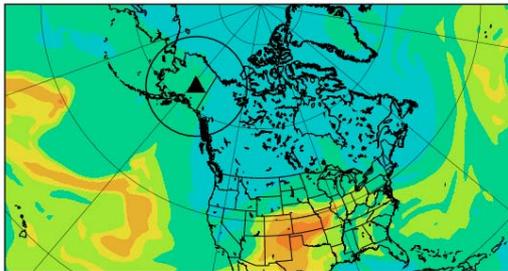
CO @ 500hPa (non-Russia Asian fossil fuel sources) [ppbV]
16:30Z03APR2008



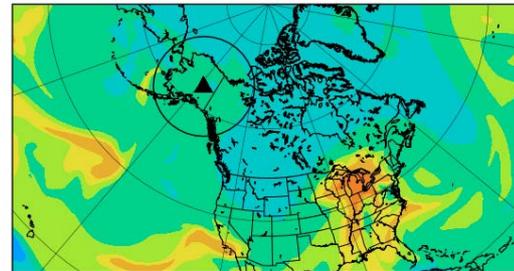
CO @ 500hPa (non-boreal biomass burning sources) [ppbV]
07:30Z30MAR2008



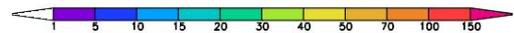
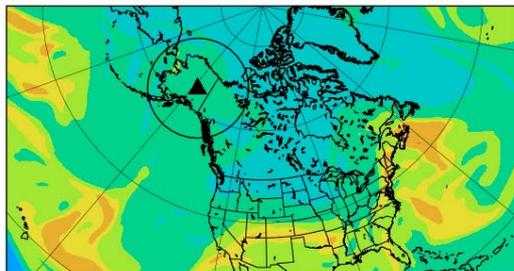
CO @ 500hPa (non-boreal biomass burning sources) [ppbV]
16:30Z30MAR2008



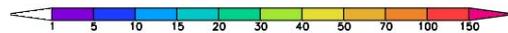
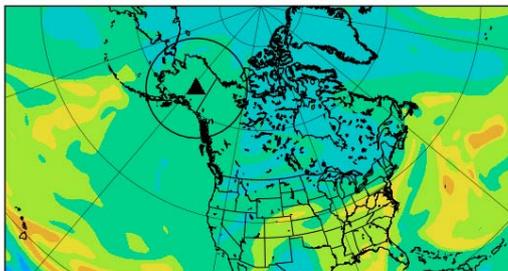
CO @ 500hPa (non-boreal biomass burning sources) [ppbV]
16:30Z31MAR2008



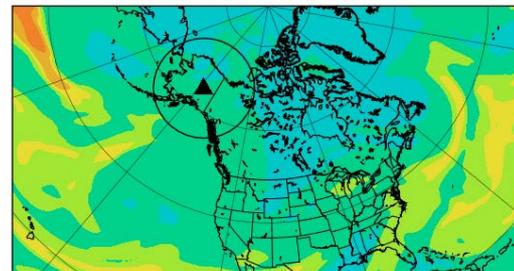
CO @ 500hPa (non-boreal biomass burning sources) [ppbV]
16:30Z01APR2008



CO @ 500hPa (non-boreal biomass burning sources) [ppbV]
16:30Z02APR2008



CO @ 500hPa (non-boreal biomass burning sources) [ppbV]
16:30Z03APR2008



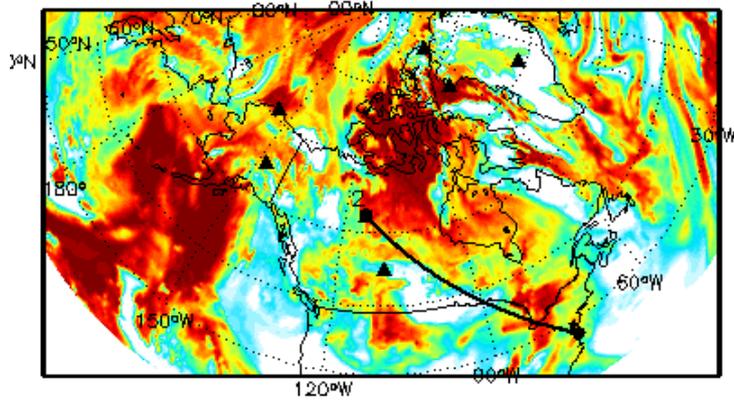
GEOS-5 Aerosol forecasts
forecast from 20080330_06Z

Take off from Wallops (37.94N, 75.46W): 1100 LT – 1500 UTC

GEOS-5 forecast: 20080330_06z

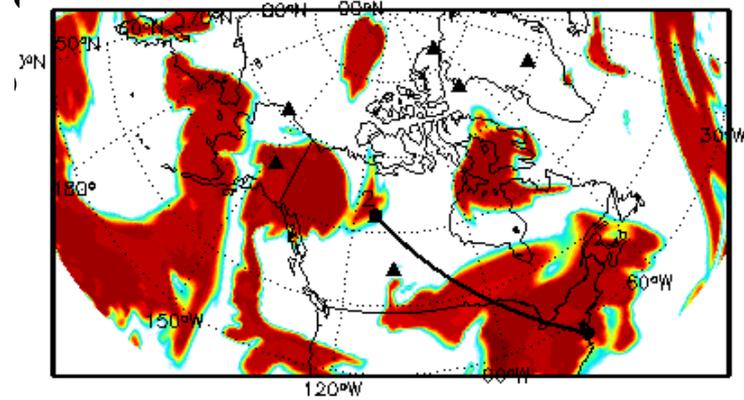
GEOS-5 forecast: 20080330_06z

CLOUD_AREA_FRACTION_FOR_LOW_CLOUDS
Surface 20080331 19:30Z



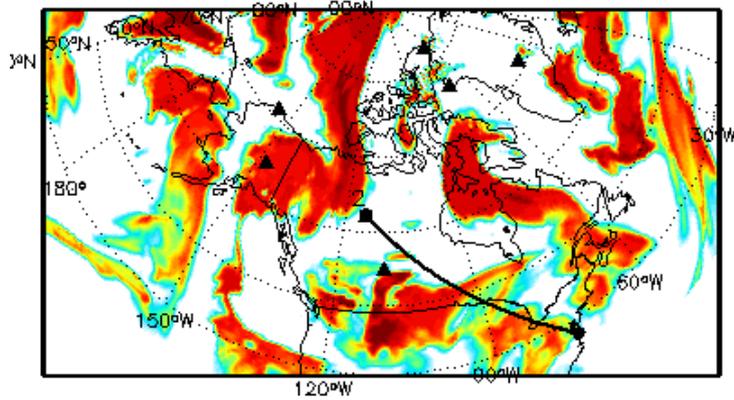
0.00 0.20 0.40 0.60 0.80 1.00

CLOUD_AREA_FRACTION_FOR_HIGH_CLOUDS
Surface 20080331 19:30Z



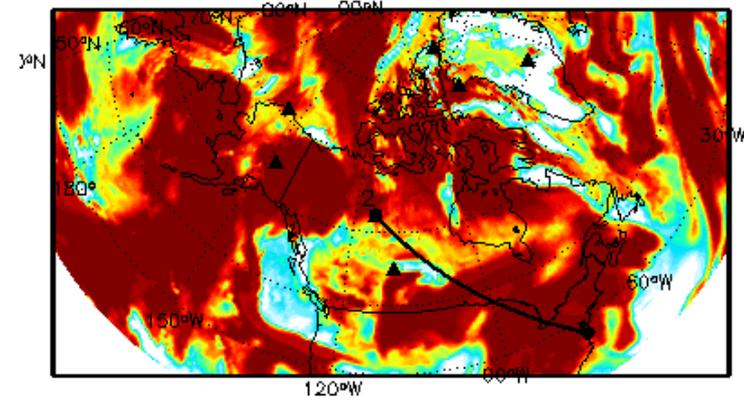
0.00 0.20 0.39 0.59 0.79 0.99

CLOUD_AREA_FRACTION_FOR_MIDDLE_CLOUDS
Surface 20080331 19:30Z



0.00 0.20 0.40 0.60 0.80 1.00

TOTAL_CLOUD_AREA_FRACTION
Surface 20080331 19:30Z



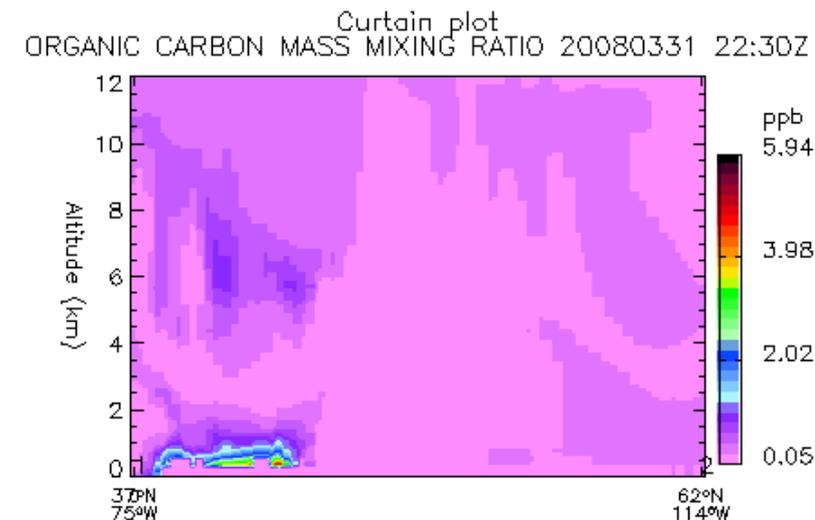
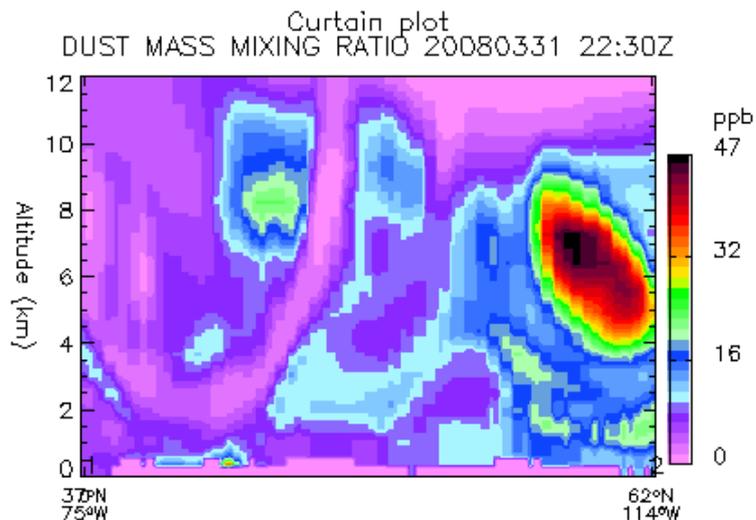
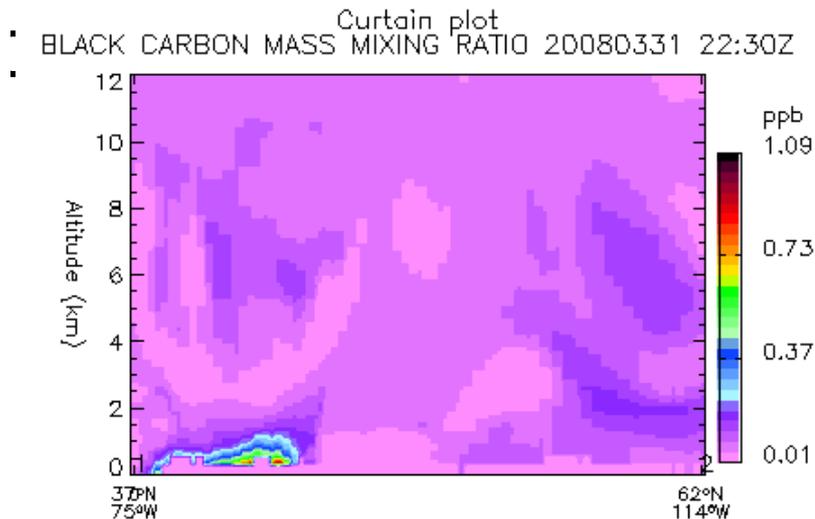
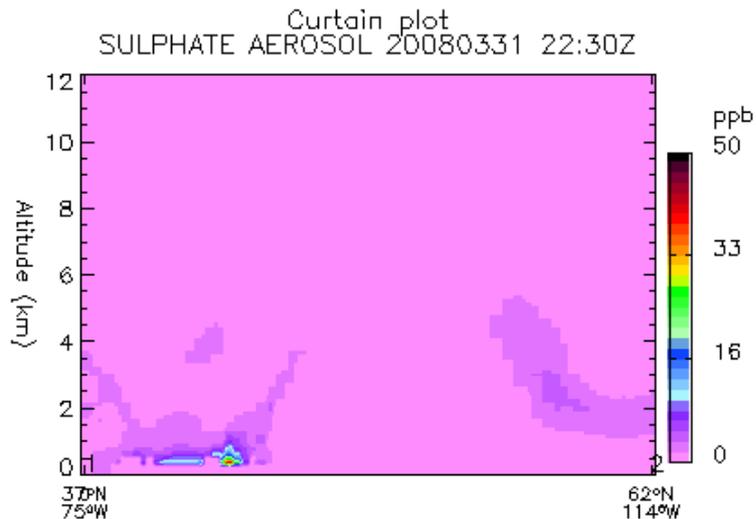
0.00 0.20 0.40 0.60 0.80 1.00

3-31-2008: Wallops to Yellowknife

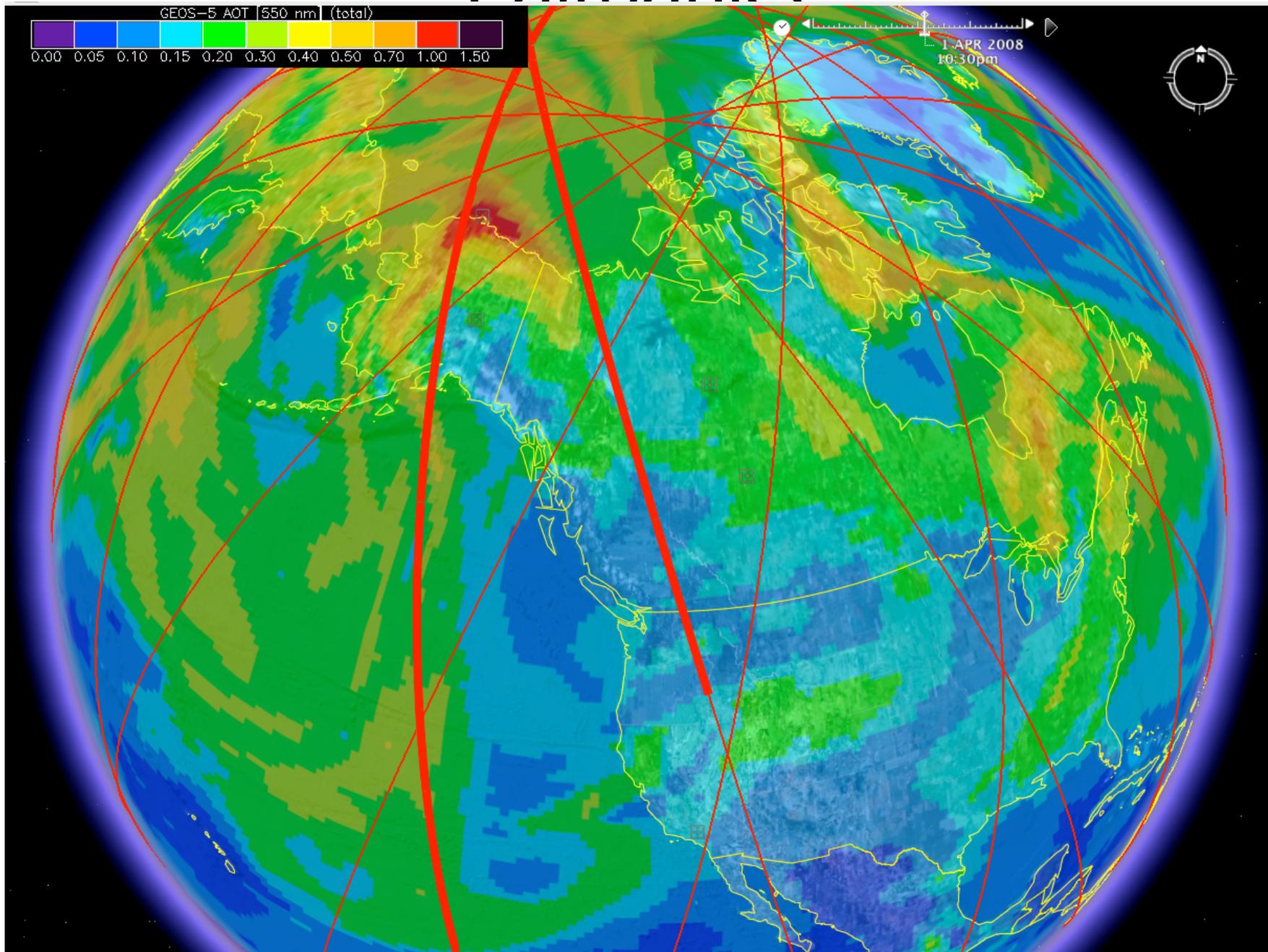
3/31 22:30 UTC (18:30 LT Wallops, 15:30

GEOS-5 forecast: 20080330_06z

GEOS-5 forecast: 20080330_06z

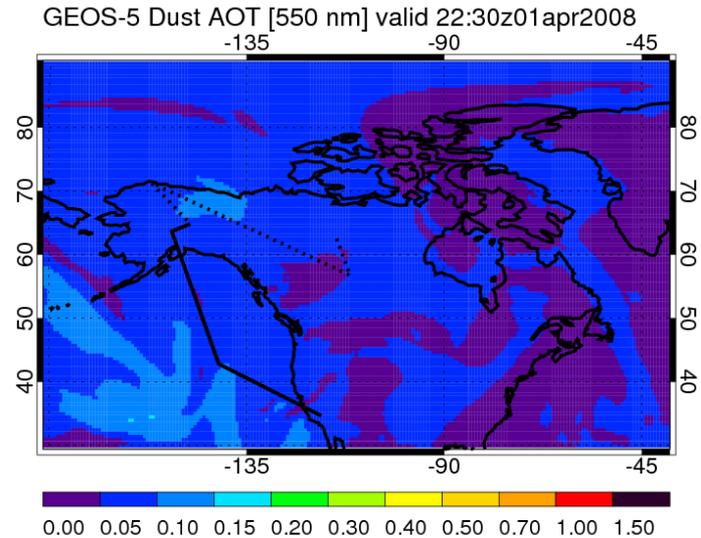
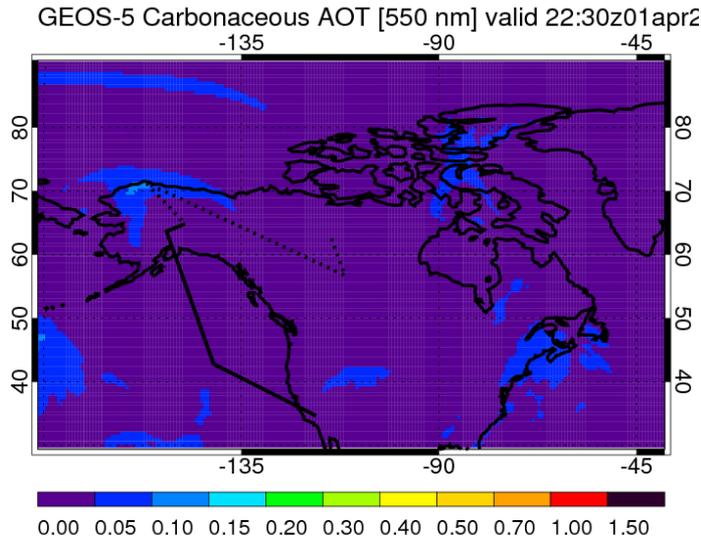
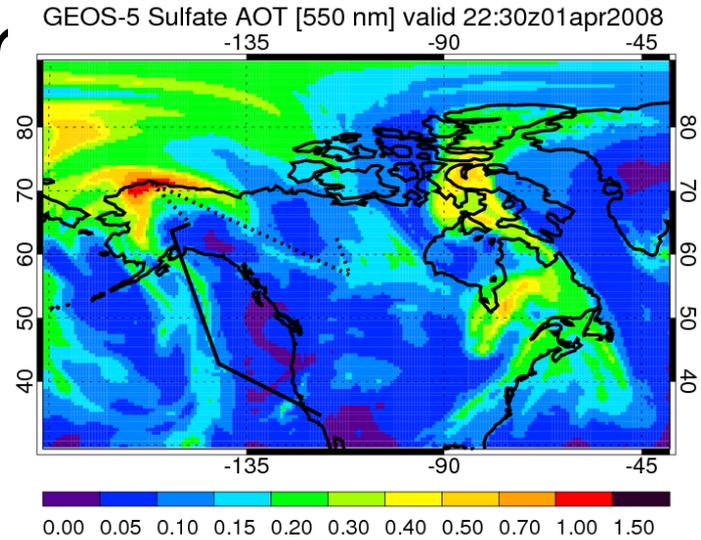
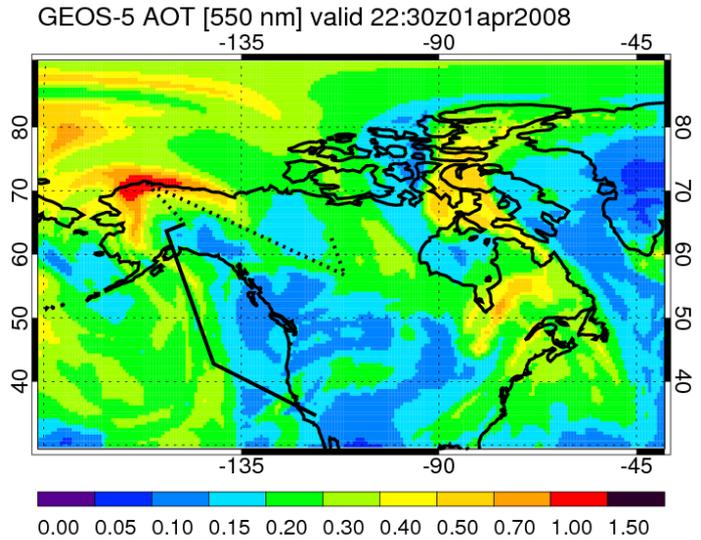


Fairbanks



4-1-2008: DC-8 and P-3 to

irbar



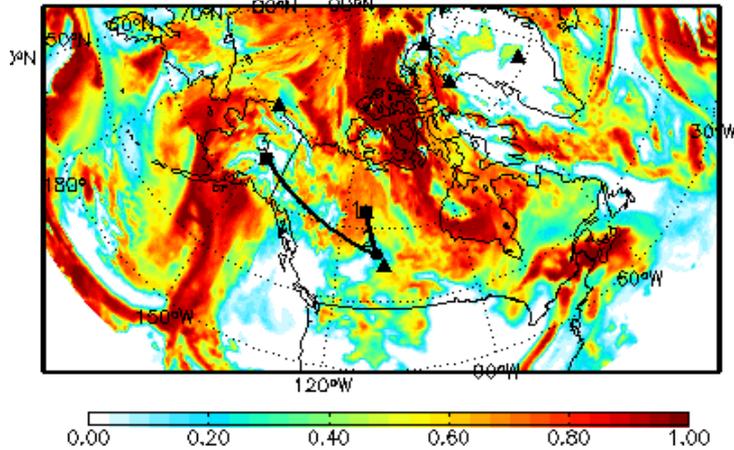
McMurray – Fairbanks

Yellowknife (62.46N, 114.45W) to Fort McMurray

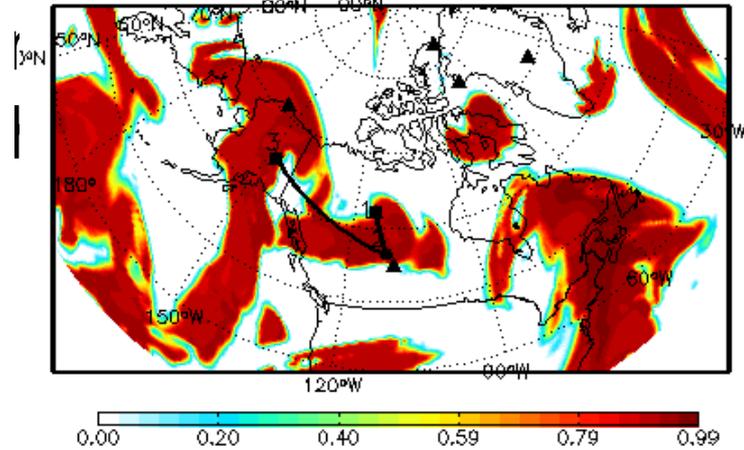
GEOS-5 forecast: 20080330_06z

GEOS-5 forecast: 20080330_06z

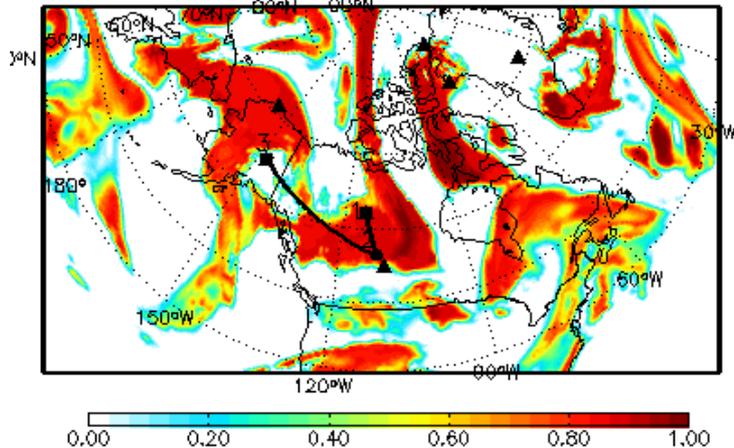
CLOUD_AREA_FRACTION_FOR_LOW_CLOUDS
Surface 20080401 19:30Z



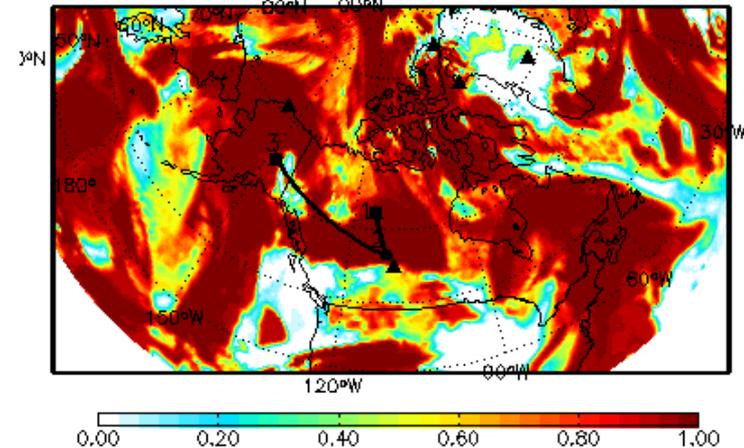
CLOUD_AREA_FRACTION_FOR_HIGH_CLOUDS
Surface 20080401 19:30Z



CLOUD_AREA_FRACTION_FOR_MIDDLE_CLOUDS
Surface 20080401 19:30Z



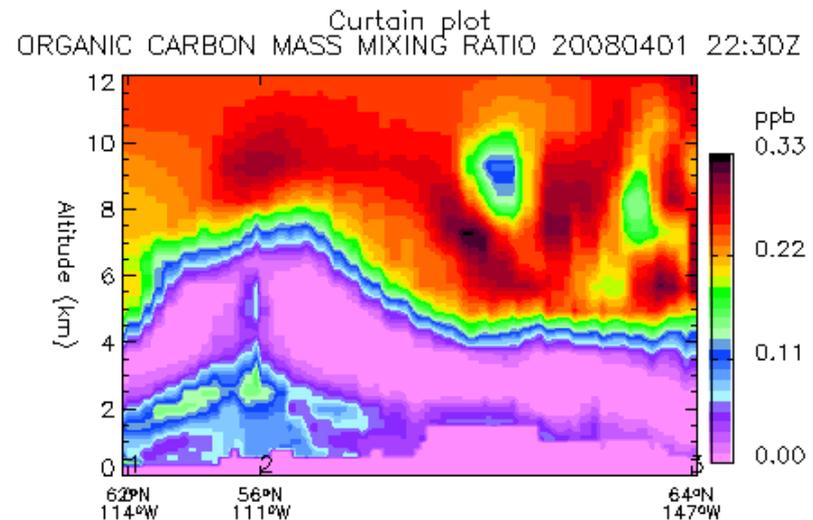
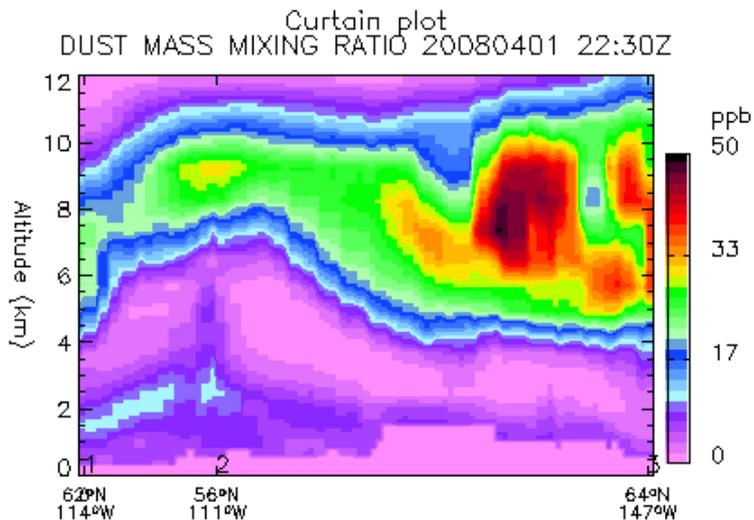
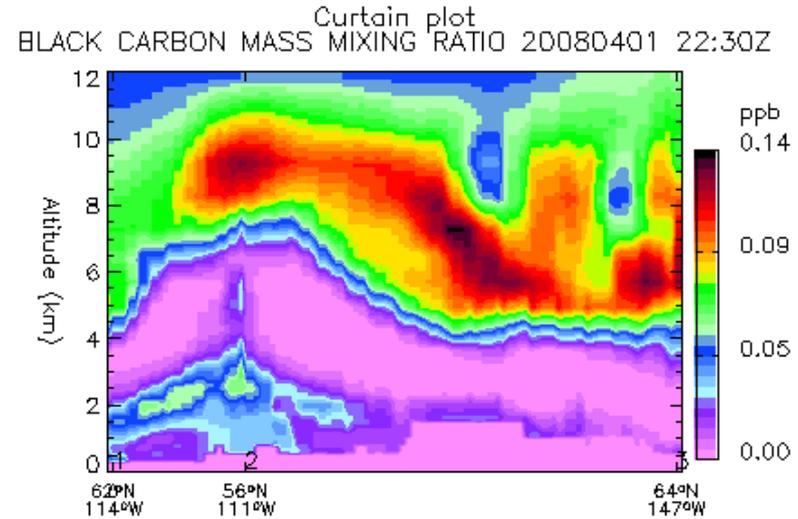
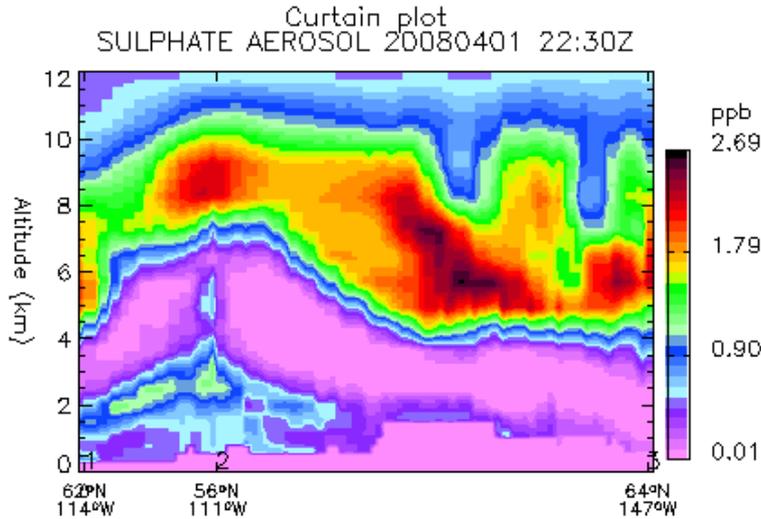
TOTAL_CLOUD_AREA_FRACTION
Surface 20080401 19:30Z



4-1-2008: (a) Yellowknife – Fort McMurray – Fairbanks

GEOS-5 forecast: 20080330_06z

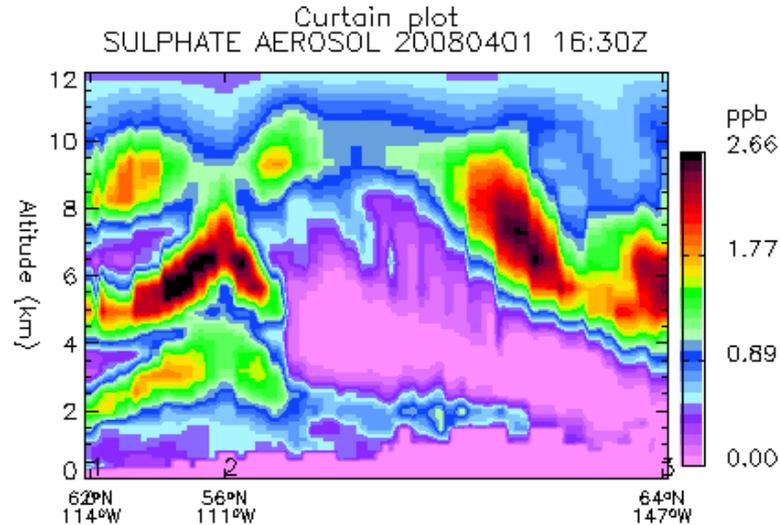
GEOS-5 forecast: 20080330_06z



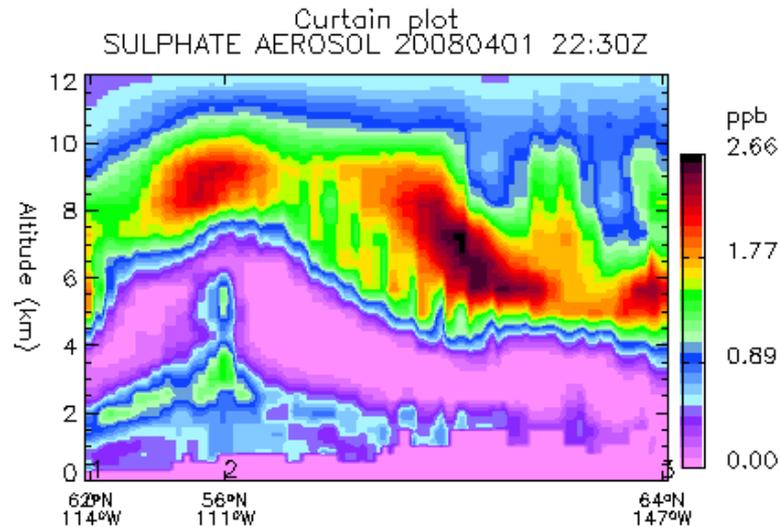
4-1-2008: (a) Yellowknife – Fort McMurray – Fairbanks

GEOS-5 forecast: 20080330_06z

1630Z



2230Z



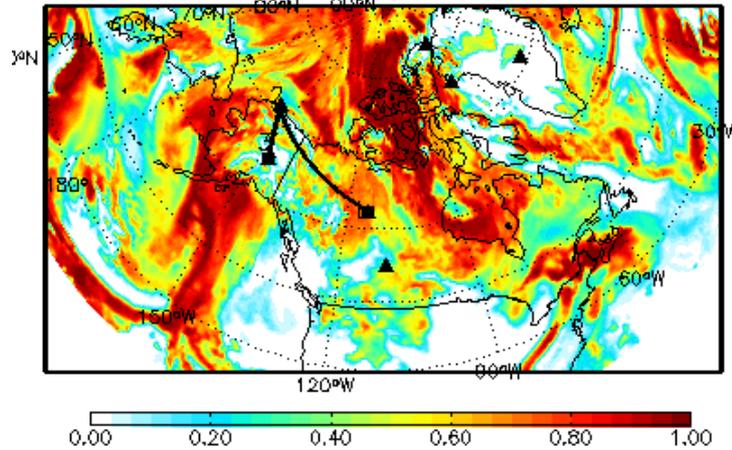
- Fairbanks

Yellowknife (62.28N, 111.27W) to Barrow

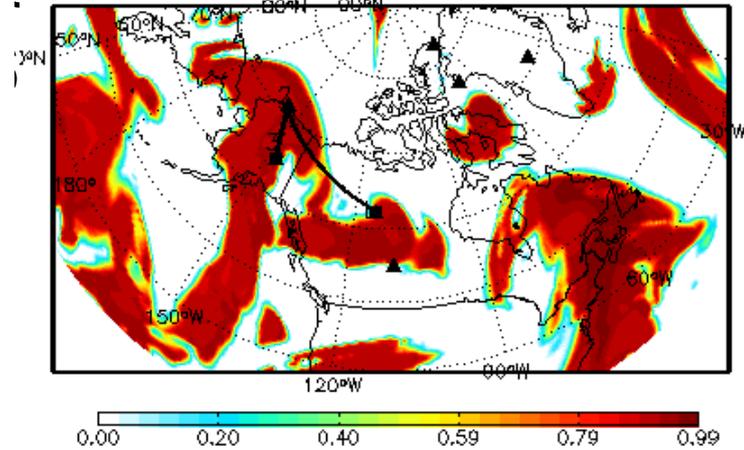
GEOS-5 forecast: 20080330_06z

GEOS-5 forecast: 20080330_06z

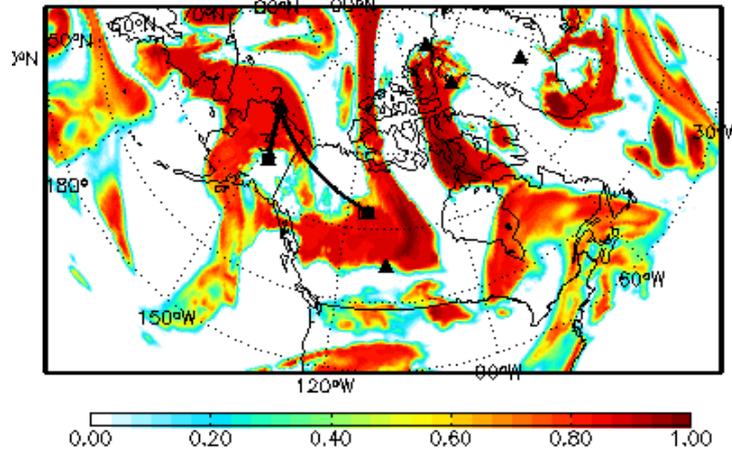
CLOUD_AREA_FRACTION_FOR_LOW_CLOUDS
Surface 20080401 19:30Z



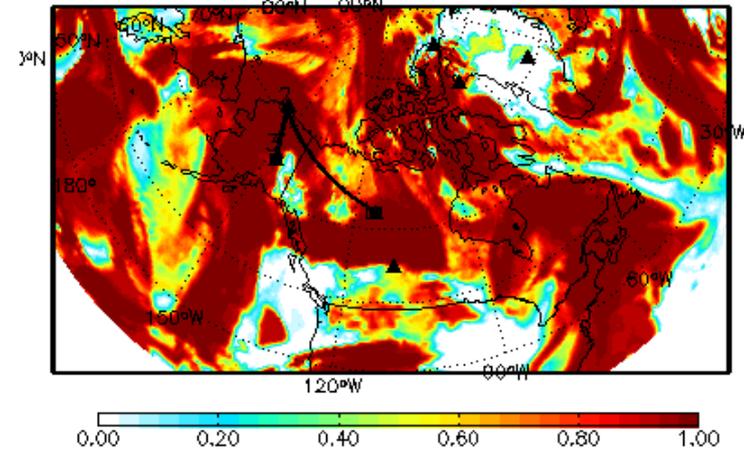
CLOUD_AREA_FRACTION_FOR_HIGH_CLOUDS
Surface 20080401 19:30Z



CLOUD_AREA_FRACTION_FOR_MIDDLE_CLOUDS
Surface 20080401 19:30Z



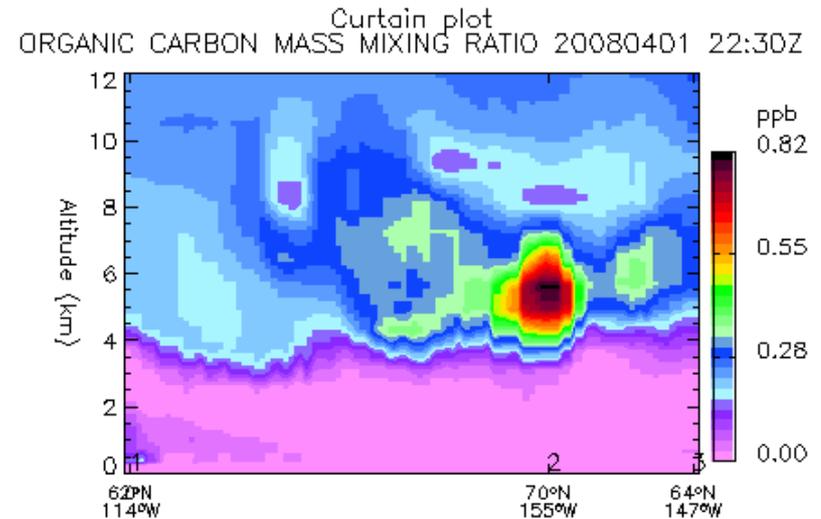
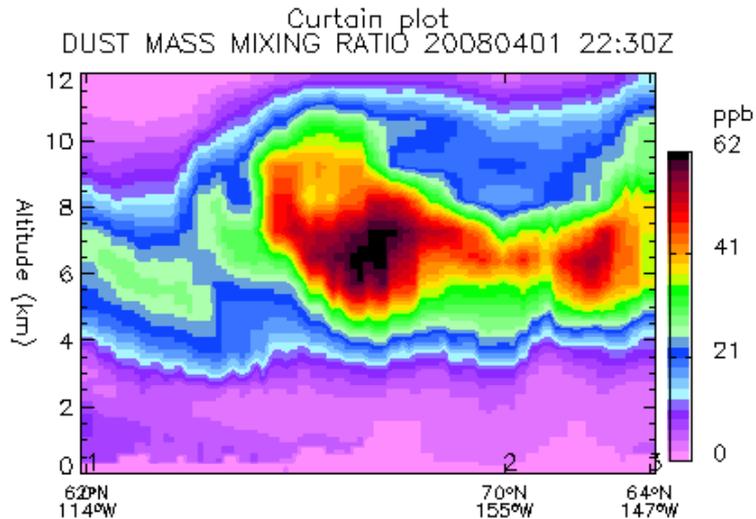
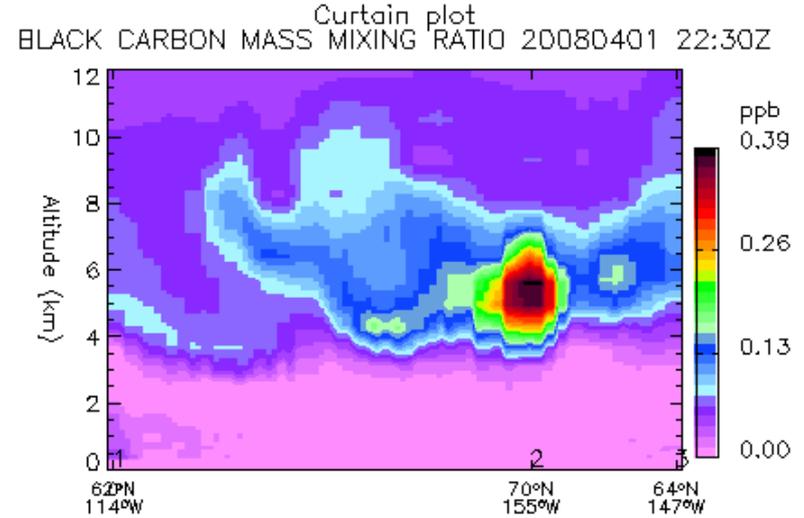
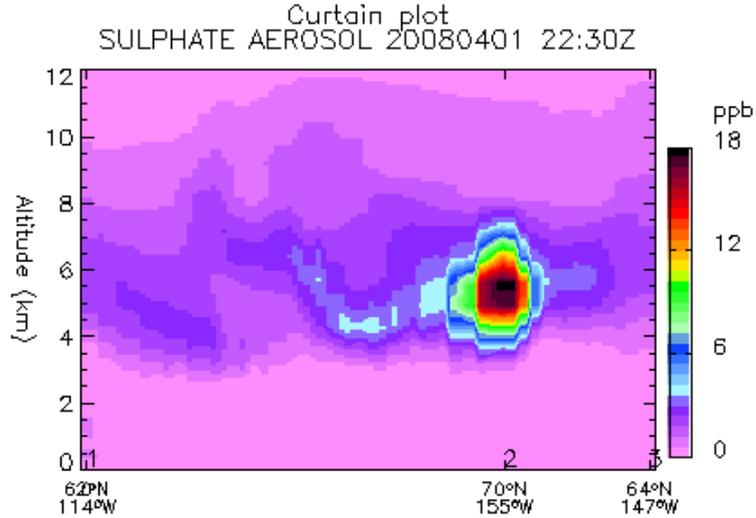
TOTAL_CLOUD_AREA_FRACTION
Surface 20080401 19:30Z



4-1-2008. (b) Yellowknife - Barrow - Fairbanks

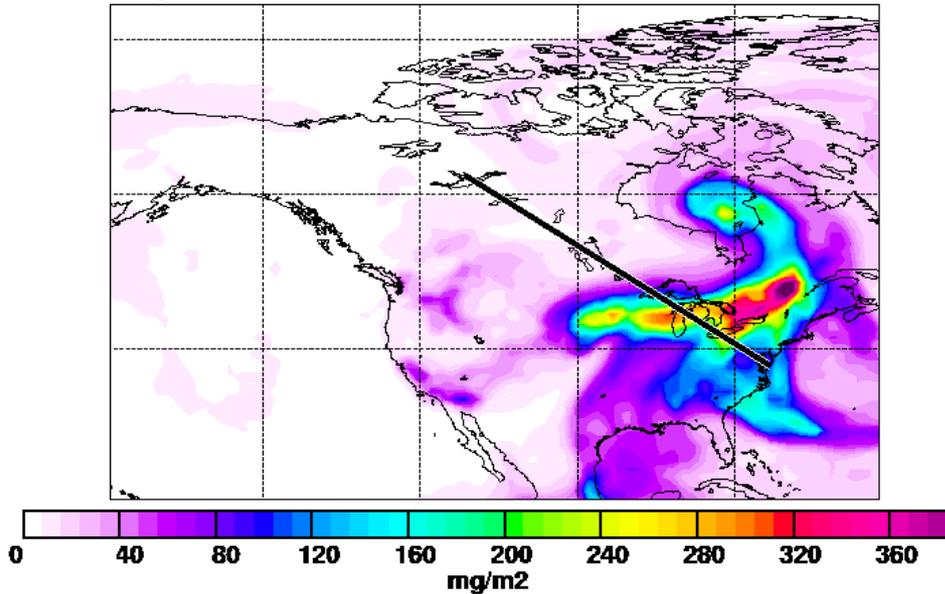
GEOS-5 forecast: 20080330_06z

GEOS-5 forecast: 20080330_06z

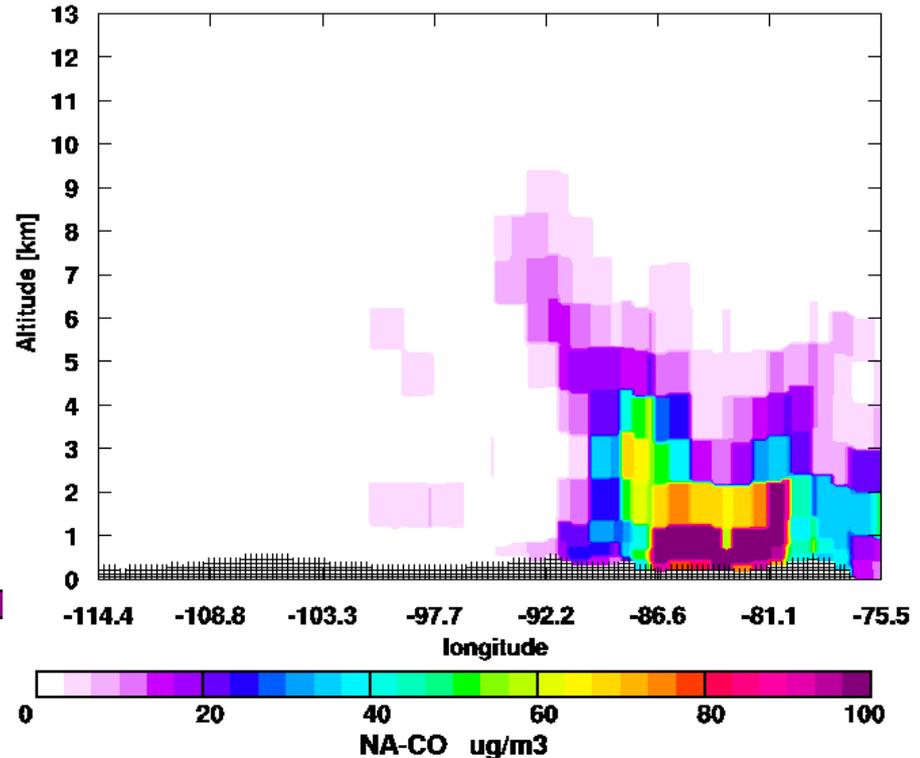


FLEXPART FC, 15-21 UTC 31 Mar, N. American plume

Total column of NA-CO for age class all
Analysis @ 20080329.210000 Actual @ 20080331.1500



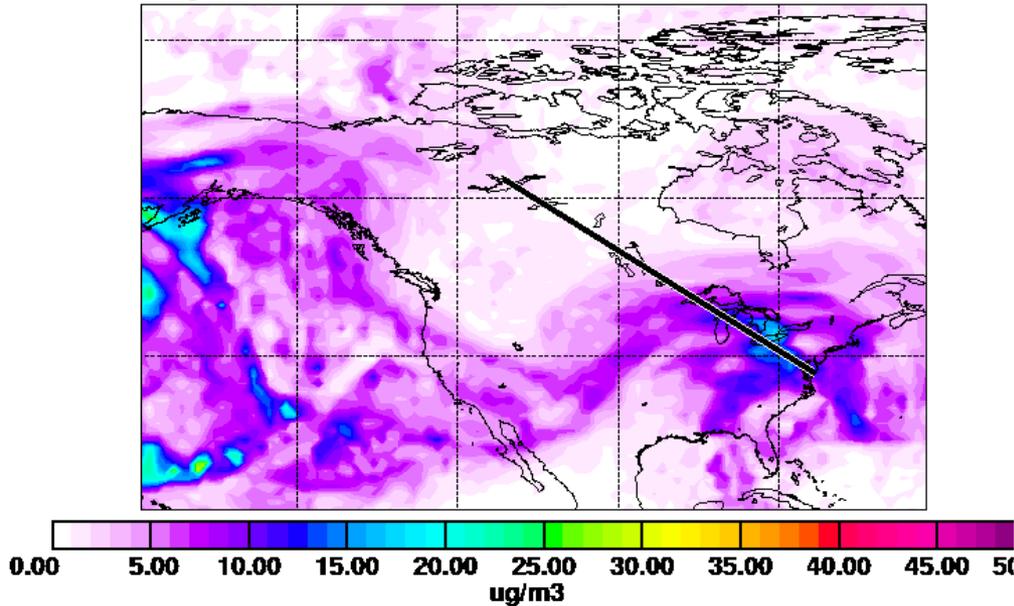
CROSS SECTION FROM 62.5 TO 37.9 LATITUDE AND -114.4 TO -75.5 LONGITUDE
NA-CO CONCENTRATION FOR AGE CLASS 0 - 20.00 DAYS
ANALYSIS @ 20080329 180000 UTC ACTUAL @ 20080331 150000 UTC



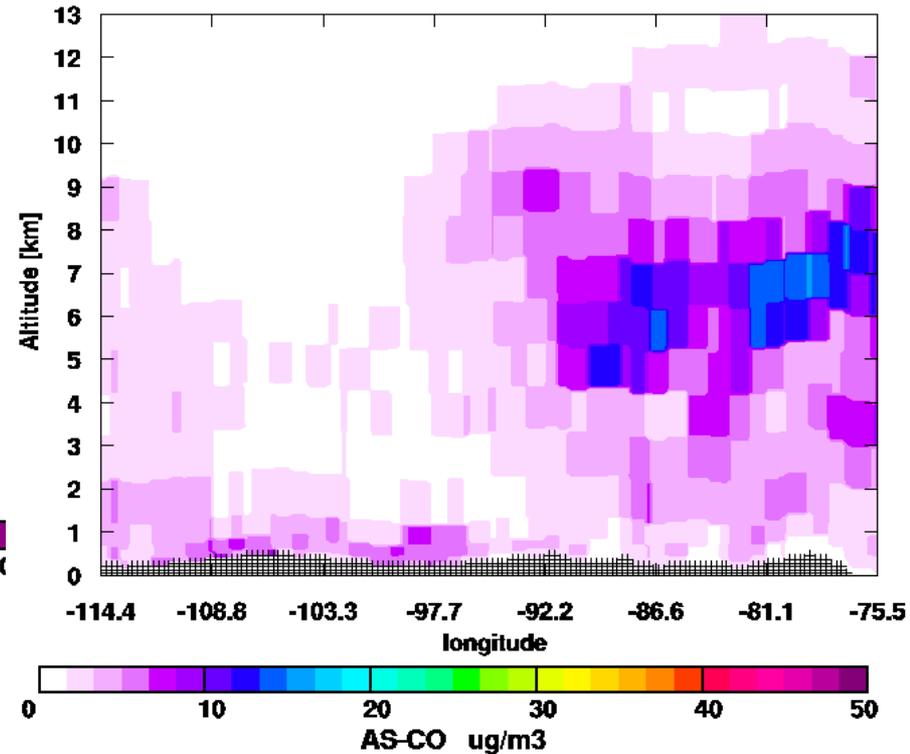
mostly below 3km alt, some up to 4-5km. Plume max south of Lake Superior. Possibly some BC at lowest levels.

FLEXPART FC, 15-21 UTC 31 Mar, Asian plume

Mixing ratio of AS-CO at 7000 m asl for age class all
Analysis @ 20080329.210000 Actual @ 20080331.1500



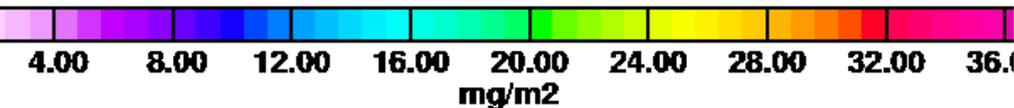
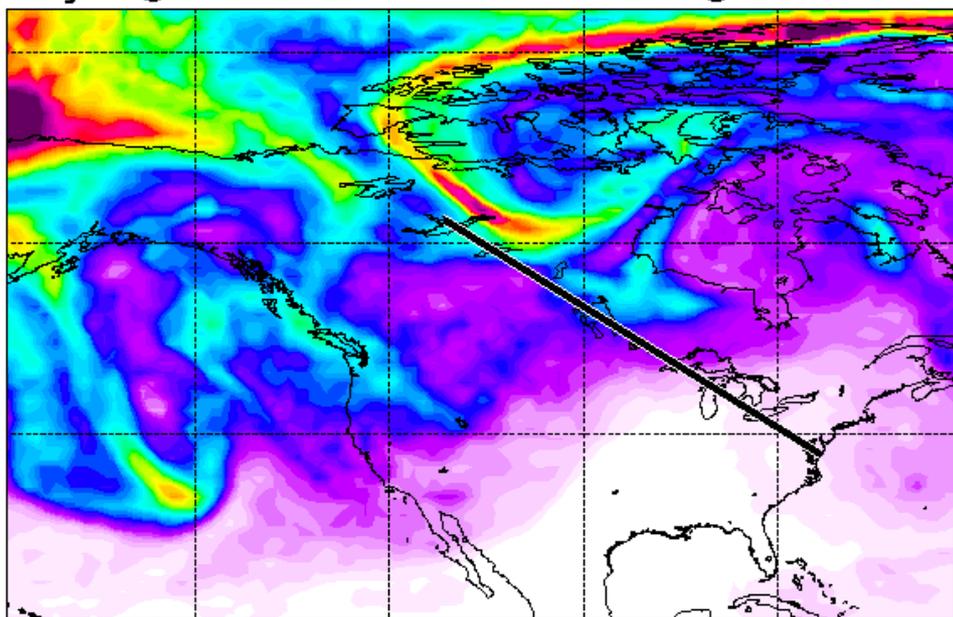
CROSS SECTION FROM 62.5 TO 37.9 LATITUDE AND -114.4 TO -75.5 LONGITUDE
AS-CO CONCENTRATION FOR AGE CLASS 0 - 20.00 DAYS
ANALYSIS @ 20080329 180000 UTC ACTUAL @ 20080331 150000 UTC



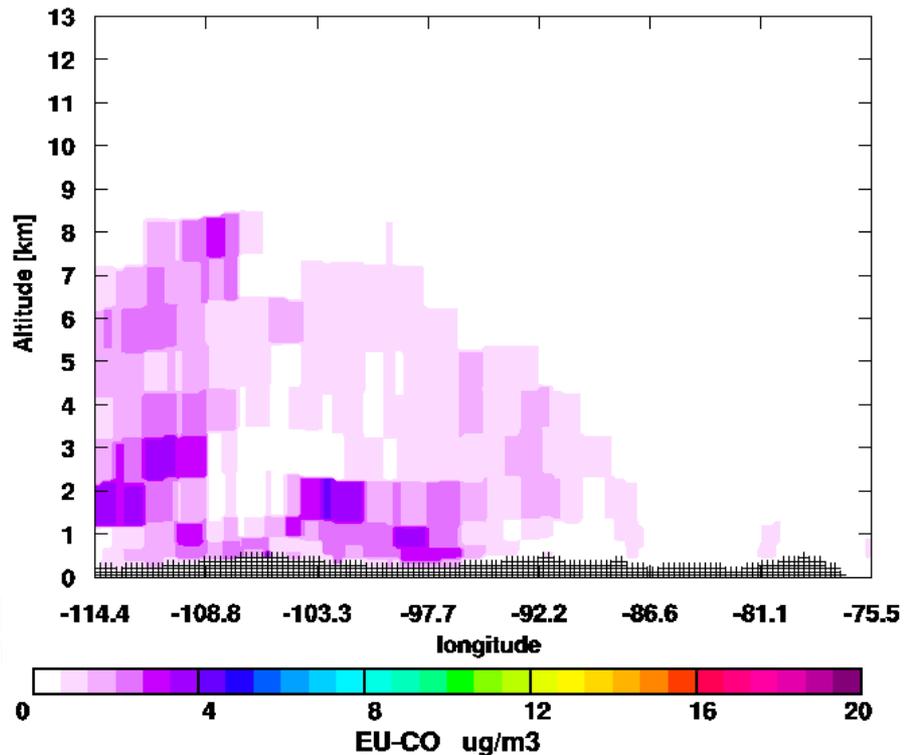
max at 7km alt along jet stream, south of 50N. Vertical extent 4-8km alt.

FLEXPART FC, 15-21 UTC 31 Mar, EU plume

Total column of EU-CO for age class all
Analysis @ 20080329.210000 **Actual @ 20080331.1500**



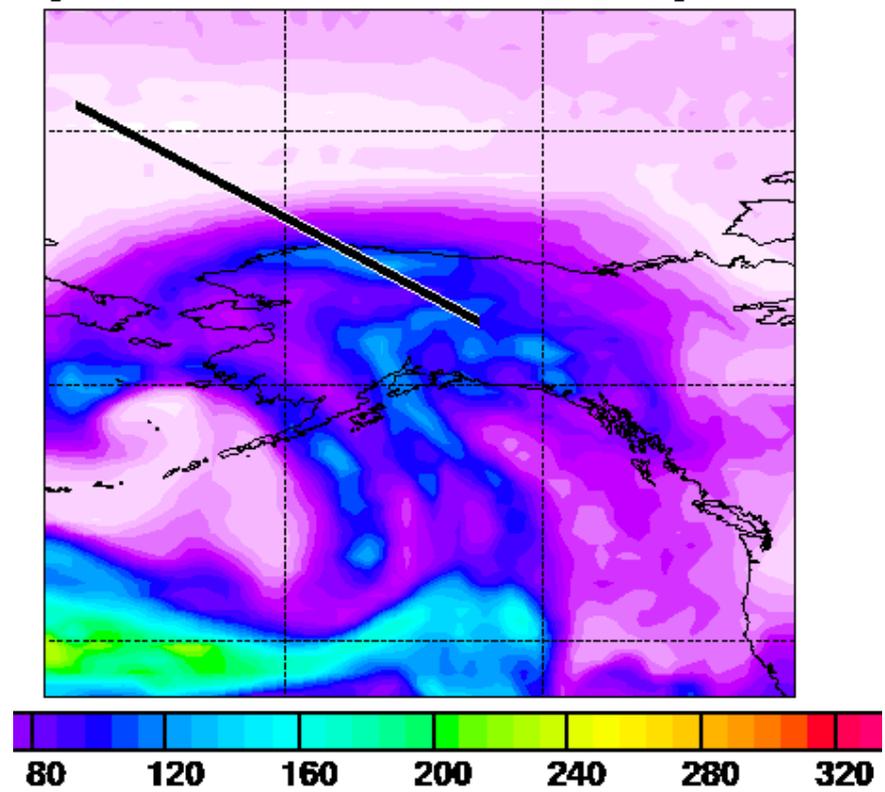
CROSS SECTION FROM 62.5 TO 37.9 LATITUDE AND -114.4 TO -75.5 LONGITUDE
EU-CO CONCENTRATION FOR AGE CLASS 0 - 20.00 DAYS
ANALYSIS @ 20080329 180000 UTC **ACTUAL @ 20080331 150000 UTC**



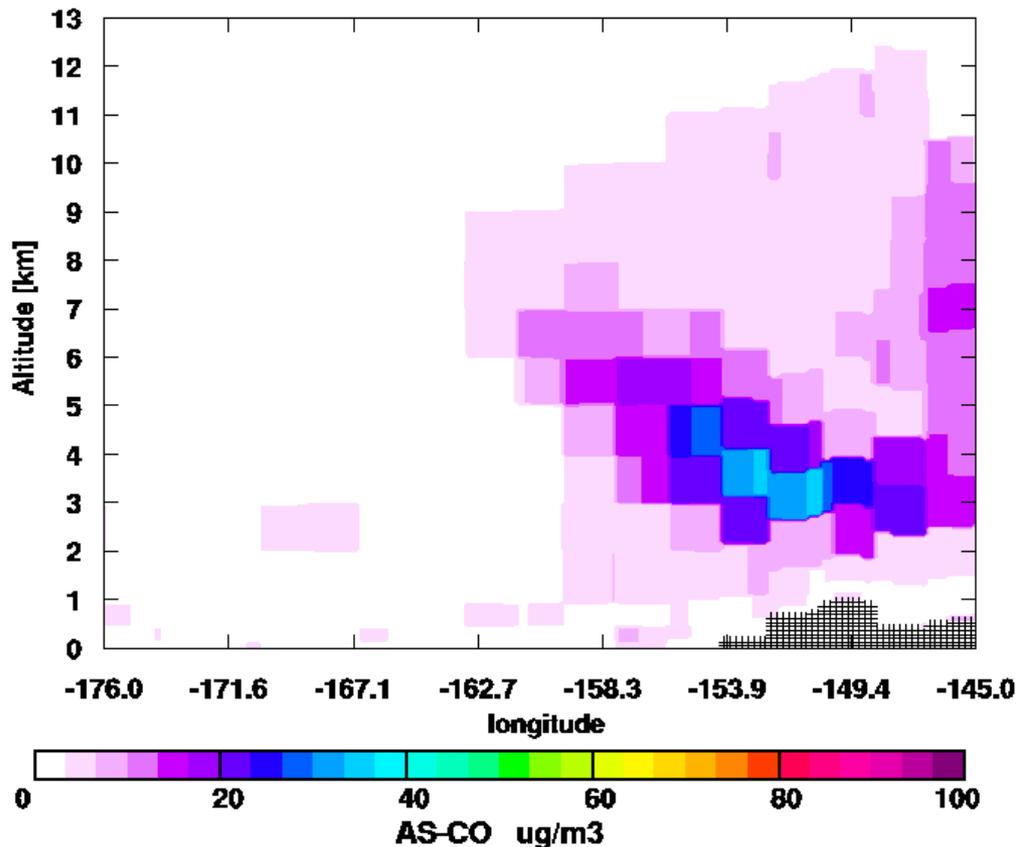
possible encounter with plume north of 50N, further towards the east, mostly around 2-3km alt.

FLEXPART FC, 15-21 UTC 1 Apr, AS plume

1 column of AS-CO for age class all
s @ 20080330. 90000 Actual @ 20080401.



CROSS SECTION FROM 82.0 TO 65.0 LATITUDE AND -176.0 TO -145.0 LONGITUDE
AS-CO CONCENTRATION FOR AGE CLASS 0 - 20.00 DAYS
ANALYSIS @ 20080330 60000 UTC ACTUAL @ 20080401 150000 UTC

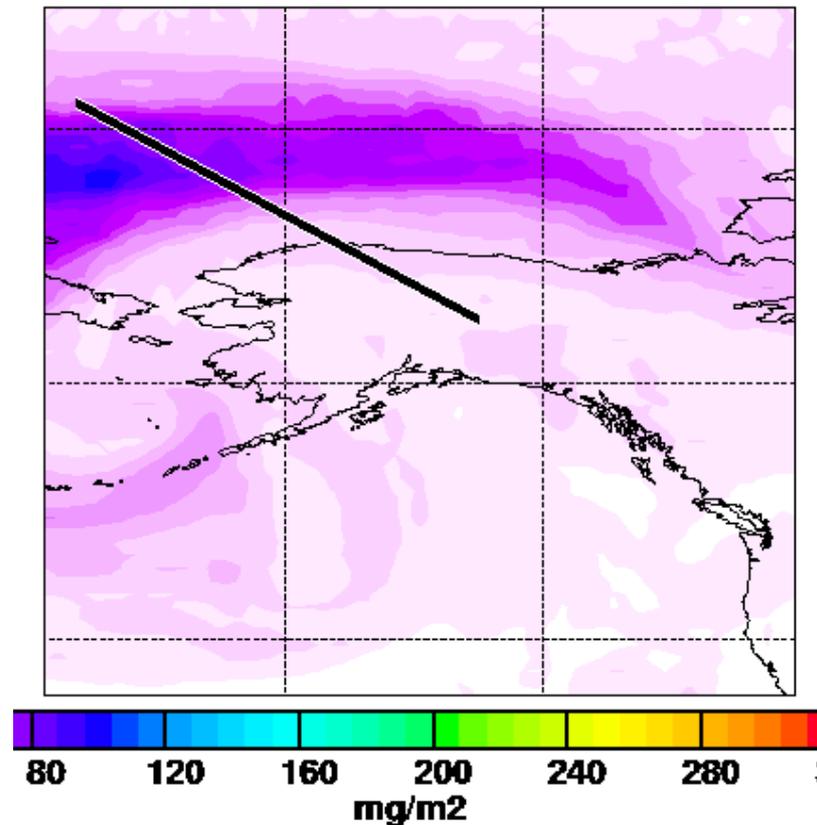


FLEXPART FC, 15-21 UTC 1 Apr, EU plume

1 column of EU-CO for age class all

3 @ 20080330. 90000

Actual @ 20080401



CROSS SECTION FROM 82.0 TO 65.0 LATITUDE AND -176.0 TO -145.0 LONGITUDE

EU-CO CONCENTRATION FOR AGE CLASS 0 - 20.00 DAYS

ANALYSIS @ 20080330 60000 UTC ACTUAL @ 20080401 150000 UTC

